User's Manual

ICP Controllers of the GDT RD Series

PCI-Wide/Ultra2 SCSI RAID Controllers

1st Edition

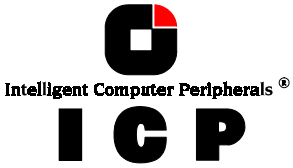
© Copyright 1998

ICP vortex Corporation
4857 West Van Buren Street
Phoenix, AZ 85043, USA

ICP vortex Computersysteme GmbH
Falterstrasse 51-53
74223 Flein - Germany

All Rights and Changes Reserved.

Intelligent Computer Peripherals ®
ICP


Intelligent Computer Peripherals ®
ICP

Contents - Overview

Part I

Chapter A	General Information
Chapter B	Hardware Installation
Chapter C	Quick-Setup

Part II

Chapter D	Using Microsoft MS-DOS, Windows 3.x/'95
Chapter E	Using Novell NetWare
Chapter F	Using Windows NT

Part III

Chapter G	The GDTMON Program
Chapter H	Appendix

The following chapters are part of a* PDF*-document which is located in a corresponding directory on the* ICP System *CDROM:

Using IBM OS/2 v2.x
Using SCO UNIX V/386
Using Interactive UNIX
Using UnixWare
GDTSETUP in Detail

Intelligent Computer Peripherals ®
ICP

Limited Warranty

ICP vortex Corporation ("ICP vortex") guarantees that this product is free from defects in material and workmanship. Subject to the conditions and limitations set forth below, ICP vortex will, at its own option, either repair or replace any part of this product which proves to be defective by reasons of improper workmanship or materials. Parts used to repair products or replacement pro ducts will be provided by ICP vortex on an exchange basis, and will be either new or refurbished to be functio n-ally equivalent to new.
This warranty does not cover any damage to this product, which results from accident, abuse, mi s-use, natural or personal disaster, Acts of God, or any unauthorized disassembly, repair or modific a-tion. The duration of this warranty is one year from the date of original retail purchase.

Warranty Claim Requirements

To obtain warranty service, return the defective product, freight prepaid and insured, to your local authorized ICP vortex dealer or distributor, or to ICP vortex Corporation, 4857 West Van Buren Street, Phoenix, AZ 85043. Please note the following: You must include the product serial number, and a
detailed description of the problem you are experiencing. You must also include proof of the date of original retail purchase as evidence that the product is within the warranty period.
If you need to return the product to ICP vortex, you must first obtain a Return Material Authorization (RMA) number by calling ICP vortex Corporation at 602-353-0303. This RMA number must be di s-played on the outside of your package. Products must be properly packaged to prevent damage in transit. ICP vortex accepts no responsibility for products which are damaged on arrival due to poor freight service.

Disclaimers

The foregoing is the complete warranty for ICP vortex products and supersedes all other warranties and representations, whether written or oral. Except as expressly set forth above, no other warranties are made with respect to ICP vortex products. ICP vortex expressly disclaims all warranties not stated herein, including, to the extent permitted by applicable law, any implied warranty of merchantability or fitness for a particular purpose. In no event will ICP vortex be liable to the purchaser, or to any user of the ICP vortex product, for any data loss, data corruption, damages, expenses, lost revenues, lost
savings, lost profits, or any other incidental or consequential damages arising from the purchase, use or inability to use the ICP vortex product, even if ICP vortex has been advised of the possibility of such damages.
ICP vortex is not liable for, and does not cover under warranty, any costs associated with servicing and/or installation of ICP vortex products.

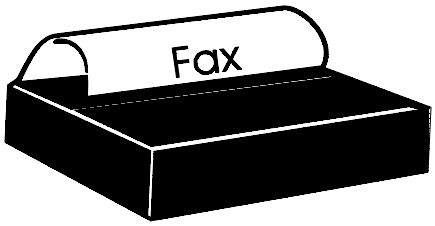
This manual has been validated and reviewed for accuracy. The sets of instructions and descriptions were accurate for ICP Disk Array Controllers at the time of this manual's pr oduction. However, succeeding Controllers, software and manuals are subject to change without notification. Therefore, ICP vortex assumes no liability for damages incurred directly or indirectly from errors, omissions or discrepancies between the Controller, software and the manual.

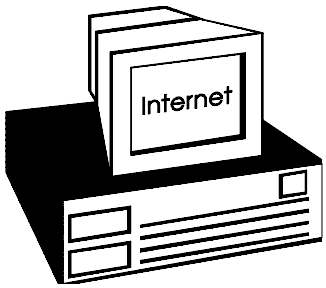
Intelligent Computer Peripherals ®
ICP

Pick up the phone

if you need technical support
and dial the numbers:
For Europe: +49-(0)7131-5972-30
For the USA: 602-353-0303

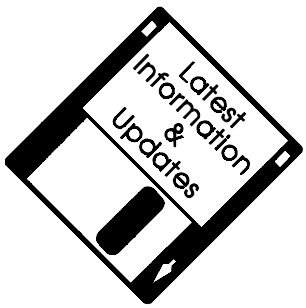
or send us a FAX:
For Europe:
+49-(0)7131-5972-31
For the USA: 602-353-0051





or send us an E-Mail:
For Europe: support@vortex.de
For the USA: support@icp-vortex.com

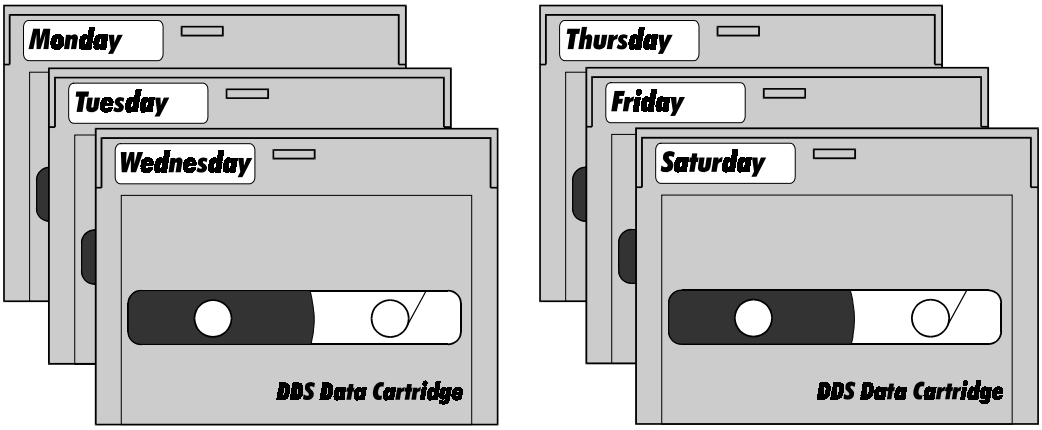
or call our BBS: 19200, 8N1,
24h, +49-(0)7131-5972-15
or check our Website:
http://www.icp-vortex.com



Intelligent Computer Peripherals ®
ICP

Important Note

Using modern RAID Systems significantly increases data security and availability. U*nder no circumstances* does it relieve you from a careful and daily backup on tape or a similar backup media. This is the only method to protect your valuable data against total loss (e.g., through fire or theft), accidental deletion, or any other destroying impacts.



Many Thanks to all my Friends

Monika & Wolfgang (the grandmasters)
AnnDee, Lois, Ken and Andreas (the Phoenix Crew)
Achim, Dieter, Günter, Norbert, Otto, Ralph, Sam, Steffen, Wolfgang (WOS), (real wizards)
Alfred (AB, "We need ultra2. I say we have it")
Andreas (AK, or "Kopf nur mit ö")
Michael (Mipf, "where is my CPU ?")
Jürgen (Jogo, "Hi, is Jurgen there ?")
Ruth (RA, "she had to proof-read that thing, ...)
Johannes (JS, "I want my ice with a red cap .., or Dr. Oops-Click-Click...")
Jürgen (JB, "diesbezüglich & hinsichtlich or probably")
Klaus (KLM, "..not an Airline..")
Markus (Malu, "Luuuuu....")
Uwe (5 Paninis for Reinhardt)

All the fantastic "rest" of this incredible company.

It is not only a pleasure to work here, it is a passion.

Intelligent Computer Peripherals ®
ICP

FCC Compliance Statement

Information for the User

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in residential installations. This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorientate or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Plug the equipment into an outlet on a circuit different from that to which the receiver is powered.
- If necessary, consult the dealer or an experienced radio/T.V. technician for additional suggestions.

The use of a non-shielded interface cable with the referenced device is prohibited.
Changes or modifications not expressly approved by ICP vortex Computersysteme GmbH could void the authority to operate the equipment.

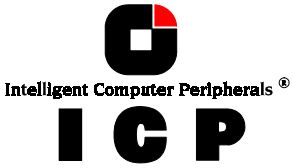
Table of Contents

A. INTRODUCTION 14
A.1 Product Identification 14
A.1.1 Key Features of the ICP Controllers of the GDT RD Series 15
A.2 Copyrights, Patents 16
A.3 Software License Agreement 17
A.4 General Information 18
A.4.1 Unpacking the ICP Controller 18
A.4.2 Delivery Contents 18
A.4.3 Contents of the GDT Driver Disks and/or CD 18
A.4.4 Before You Start 18
A.5 Product Description 19
A.5.1 Intel i960RD I/O Processor 19
A.5.2 Architecture - General 32 BIT 19
A.5.3 Cache RAM - Expandable to 128MB 19
A.5.4 Compatibility - PCI 19
A.5.5 Up to 5 Wide/Ultra2 SCSI Channels 19
A.5.6 ICP Controller Firmware, PCI-BIOS and GDTSETUP 20
A.5.7 Configuration Program GDTSETUP 20
A.5.8 Diagnosis Program GDTMON 20
A.5.9 Operating System Driver Software 21
A.5.10 ICP Controller GDT RD Series Board Layout 21
B. HARDWARE INSTALLATION 30
B.1 Before Installation 30
B.2 Tools 30
B.3 Installing the Cache RAM SIMM 30
B.4 SCSI - Basics 32
B.4.1 SCSI Cables 33
B.4.2 SCSI Termination 38
B.4.3 SCSI ID 40
B.4.4 ICP SCSI Accessories 41
B.4.5 Examples 44
B.5 Installing the ICP Controller 50
B.7 ICP Controller Function Check 51
B.7.1 PCI 2.x Compatibility Requirements 51

B.7.2 Switching On the PCI Computer System 52
B.7.3 Trouble Shooting 54
B.8 Checking the ICP Controller Configuration 55
B.8.1 Loading GDTSETUP 55
B.8.2 Updating the ICP Controller With New Firmware 58
B.8.3 Additional Notes 60
C. QUICK-SETUP 62
C.1 What is the Aim of Quick-Setup ? 62
C.2 What is the ICP Controller Firmware ? 63
C.2.1 The Different RAID Levels 64
C.3 How are the GDT Firmware Features Activated ? 66
C.3.1 The Express Setup Function of GDTSETUP 67
C.4 Levels of Hierarchy Within the GDT Firmware 70
C.5 Using CD-ROMs, DATs, Tapes, etc. 71
C.6 Example 1 - Installing a Single SCSI Hard Disk 71
C.7 Example 2 - Installing a Mirroring Array - RAID 1 83
C.8 Example 3 - Installing a RAID 5 Disk Array 90
C.8.1 Mechanical Structure, Electrical Connections 90
C.9 Example 4 - RAID 5 Disk Arrays With a Hot Fix Drive 112
C.10 Trying to Answer The Initial Questions 122
C.10.1 How Many Hard Disks Should be Integrated ? 122
C.10.2 Which Level of Redundancy is Needed ? 123
C.10.3 Do we Need Hot Fix drives ? 123
C.11 States of a RAIDYNE Disk Array 124
C.11.1 "Idle" State 124
C.11.2 "Build" State 124
C.11.3 "Ready" State 124
C.11.4 "Fail" State 124
C.11.5 "Rebuild" State 124
C.11.6 "Expand" State 125
C.11.7 "Error" State 125
D. USING MICROSOFT MS-DOS 128
D.1 Transparency of Host Drives 128
D.2 Partitioning a Host-Drive and Transferring MS-DOS 128
D.3 CONFIG.SYS and the Driver GDTX000.EXE 132
D.4 Expanded Memory Managers 133

D.5 Using Windows 3.x 133
D.6 Using a CD-ROM Drive under MS-DOS or Windows 3.x 134
D.6.1 Example: Using the ASW Software for the CD-ROM 135
D.6.2 Example: Using corelSCSI for the CD-ROM 136
D.7 The GDT ASPI Manager GDTASPI.EXE 137
D.7.1 Using ASW ASPIDISK.SYS 137
D.7.2 Using corelSCSI 138
D.8 Installing Windows 95 139
D.8.1 The ICP controller is the primary controller 139
D.8.2 The ICP controller is the secondary controller 140
D.8.3 Update the ICP Windows 95 Driver 141
E. USING NOVELL NETWARE 144
E.1 Transparency of Host Drives 144
E.2 Novell NetWare 3.10, 3.11 and 3.12 144
E.3 Novell NetWare 4.x 144
E.4 Tips and Tricks 145
E.4.1 Optimize Data Throughput 145
E.4.2 'cache memory allocator out of available memory' 146
E.4.3 Installing NetWare 4.1 - Wrong Drive Name 146
E.4.4 NetWare-Server Not Stable When High Utilization 146
E.4.5 ICP Controller and Non-ASPI Compatible Controllers 147
E.4.6 Last Status Information 147
E.4.7 Adding Additional Capacity After An Online Expansion 147
E.5 Notes on ARCserve 147
F. USING MICROSOFT WINDOWS NT 150
F.1 Transparency of Host Drives 150
F.2 General Information on Windows NT 150
F.3 Preparing the Installation 150
F.4 The Installation 152
F.4.1 The ICP Controller is the only Controller in the System 152
F.4.2 The ICP Controller is the Secondary Controller in the System 153
F.4.3 Using the Hot Plug Function with RAID Host Drives 153
F.4.4 Installation of a new GDTX.SYS Driver Version 153
F.5 Installation of a Removable Hard Disk 154
F.6 Tips & Tricks 155
F.6.1 ICP Controller not Found During Windows NT Installation 155

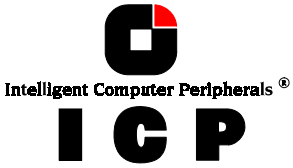
F.6.2 Installation and Upgrade of Windows NT 3.5x / 4.x 155
F.6.3 Adding Additional Capacity After An Online Expansion.....156
G. THE DIAGNOSIS PROGRAM GDTMON.....158
G.1 Loading GDTMON.....159
G.1.1 Loading the GDTMON Program Under NetWare.....160
G.1.2 Loading the GDTMON Program Under OS/2.....160
G.1.3 Loading the GDTMON Program Under Windows NT 160
G.1.4 Loading the GDTMON Program Under Windows 95.....160
G.1.5 Loading gdtmon under SCO UNIX.....161
G.2 The GDTMON Program.....161
G.2.1 Select Controller.....161
G.2.2 Host Drives 163
G.2.3 Logical Drives.....164
G.2.4 Physical Drives.....166
G.2.5 Cache Statistics 167
G.2.6 Sampling Rate 168
G.3 The Menu: View/Change Settings 169
G.3.1 Notes and Information on the Hot Plug function of GDTMON 170
G.3.2 Controller 171
G.3.3 Cache Settings 172
G.3.4 Physical Drives.....173
G.3.5 Logical Drives.....175
G.3.6 Array Drives 191
G.3.7 Save Information 213
H. APPENDIX.....216
H.1 Technical Data of the ICP Controller.....216
H.2 Power-On Error Messages Issued by the ICP Controller 216
H.3 Index.....217


Intelligent Computer Peripherals ®
ICP

Chapter A

General

Information



A. Introduction

GDT RD Series: PCI Hardware RAID Disk Array Controllers with 1, 2, 3 or 5 Wide/Ultra2 SCSI Channels and one Narrow/Ultra SCSI Channel

In order to take full advantage of modern operating systems, high performance computer systems are needed. When assessing the performance of a computer system, the aspects speed and security of the mass-storage subsystem are gaining increasing importance. As a result of the constantly growing acceptance of the RAID technology (Redundant Array of Inexpensive Disks) in these computer systems, and the identification of the RAID controller as the essential part of a disk subsystem, a strong demand for suitable RAID controllers has emerged during the past few years.

Since 1990, ICP vortex has been intensively engaged in the research and development of RAID products for the highest performance and security requirements. Due to our products' outstanding performance, our expertise and continuity in development, ICP Controllers are accepted and known as top leading-edge products all over the world. ICP Controller products within the GDT RD Series offer customers a wide variety of RAID controllers, suitable for the most different platforms and applications. All ICP Controllers of the GDT RD Series are *pure-bred* ***hardware solutions***. All functionality required for the sometimes very complex tasks is hardware-implemented on the controller. Thus, RAID is fully independent of the computer system (the host) and the operating system.

Thanks to the wide operating system support and easy-to-use installation and maintenance utilities, setting up and using high performance and fault-tolerant mass-storage subsystems for almost every purpose is child's play.

We would like to thank you for purchasing an ICP Controller of the GDT RD Series.

ICP - Intelligent Computer Peripherals ®

A.1 Product Identification

In order to meet the various customer and system requirements, ICP vortex offers 6 different Wide/Ultra2 SCSI Disk Array Controllers for PC-based PCI computer systems. The main differences between the two controllers lie in the number of Wide/Ultra2 SCSI Channels.

Art.No.	ICP Controller Name	Number Wide/Ultra2 SCSI Channels	Narrow/Ultra SCSI Channel	Supported RAID Levels
7805	GDT6118RD	1	1	0, 1
7806	GDT6128RD	2	1	0, 1
7817	GDT6518RD	1	1	0, 1, 4, 5, 10
7827	GDT6528RD	2	1	0, 1, 4, 5, 10
7837	GDT6538RD	3	1	0, 1, 4, 5, 10
7857	GDT6558RD	5	1	0, 1, 4, 5, 10

A.1.1 Key Features of the ICP Controllers of the GDT RD Series

- Hardware RAID Controllers with RAID 0, RAID 1, RAID 4, RAID 5 and RAID 10 Array Drives at controller level, completely independent of the computer system and the operating system. Several Array Drives can be operated simultaneously.
- "Private" (i.e., for one Array Drive) or "Pool" (i.e., for several Array Drives) Hot Fix Drives.
- Online Capacity Expansion. Add one or several new disk drives to an existing Array Drive to expand its capacity. During the Expansion all data are redundant.
- Online RAID Level Migration. Online change of an Array Drive's RAID Level, e.g., from RAID 0 to RAID 5.
- Online Capacity Expansion and RAID Level migration can be performed simultaneously.
- Configuration Utility (GDTSETUP) in ROM. Express Setup option to easily setup Array Drives. Press "CTRL-G" to load GDTSETUP, long before the operating system is booted.
- Advanced Multi-Processor RISC Technology.
- On-Board i960RD © Intelligent I/O Processor. Completely offloads the host CPU.
- 1, 2, 3 or 5 Wide/Ultra2 SCSI Channels with 32 bit SCSI RISC processors. Dual connector system with 1, 2 and 3 channel models (internal 50 & 68 pin connector). Up to three external Ultra High Density SCSI connectors.
- Cable length up to 12 meters per channel. Synchronous data transfer rate up to 80MB/sec per channel. .
- Up to 15 Devices per Wide/Ultra2 SCSI channel.
- 1 full-featured additional Narrow/Ultra SCSI channel for legacy SCSI devices (hard disks, CD-ROMs,. etc.) with third generation 32 bit SCSI RISC processors and an active, software-switchable termination. Synchronous data transfer rate up to 20MB/sec.
- Cache RAM: 4MB, 8MB, 16MB, 32MB, 64MB, or 128MB. One standard 72 PIN, 32 Bit or 36 Bit PS/2 SIMM. FPM (Fast Page Mode) or EDO (Extended Data Out) Dynamic-RAM technology. With EDO SIMMs increased performance. Automatic Cache RAM detection.
- Intelligent multi-level cache-algorithm with adaptive delayed write and read ahead functions. This ensures an optimized cache for various load profiles and system requirements.
- On-Board PCI 2.x compatible BIOS (Plug & Play).
- BIOS, Firmware and GDTSETUP in Flash-RAM. Easy update through floppy disk or BBS-download.
- GDTMON. Monitor program for the diagnosis (also remote) of ICP Controllers & Array Drives. The tool allows you to optimize existing configurations.
- Drivers for MS-DOS, Novell NetWare, SCO UNIX V/386, Interactive UNIX, UnixWare, Linux, Windows NT, Windows 95 and OS/2. ASPI-Managers for DOS, Windows and Novell NetWare. I_20 ready controller design.

A.2 Copyrights, Patents

Parts of the ICP GDT RD Series controllers are protected under international copyright laws and agreements. No part of the product or the manual, or parts of the manual may be reproduced in any form, physical, electronic, photographic, or otherwise, without the expressed written consent of ICP vortex Computersysteme GmbH. For this product a patent is registered at the Deutsches Patentamt in Munich with the official reference no. 4121974.

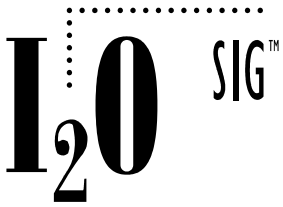
All special names and trademarks of manufacturers quoted in this manual are protected by copyright.

ICP - Intelligent Computer Peripherals ® and **RAIDYNE ®**, are registered trademarks of ICP vortex Computersysteme GmbH.

Europe:
ICP vortex Computersysteme GmbH ▪ Falterstraβe 51-53 ▪ 74223 Flein - Germany ▪ Phone: +49-(0)-7131-5972-0 ▪ Fax: +49-(0)-7131-255063 BBS: +49-(0)-7131-5972-15 (24h; 19200, 8N1) ▪ E-Mail: support@vortex.de ▪ WWW: http://www.icp-vortex.com

United States of America:
ICP vortex Corporation ▪ 4857 West Van Buren Street ▪ 85043 Phoenix, Arizona ▪ Phone: 602-353-0303 ▪ Fax: 602-353-0051 ▪ E-Mail: support@icp-vortex.com ▪ WWW: http://www.icp-vortex.com

ICP vortex is member of the RAID Advisory Board, the PCI Special Interest Group (PCI SIG) and founding member of the I_2O Special Interest Group (I_2O SIG):



A.3 Software License Agreement

Please read this Software License Agreement before opening the CD/disk packaging and before starting to use the programs. Each loading of a program covered by this license agreement, each transmission within any existing network to another computer, as well as each copy on a mass storage system, regardless of what kind (floppy disk, hard disk,CD, MO, etc.), represents a duplication of the program according to copyright regulations. Duplication is permitted only with the authorization of ICP vortex.
This authorization will be granted only on the condition that the Software License Agreement stated hereafter is observed.

By opening the CD/disk packaging you expressly acknowledge the Software License Agreement of ICP vortex.

1. You are authorised to use the software contained on the enclosed disks, CD-ROMs and EPROMs/Flash-RAMs on a single computer system only. The restriction to this one computer system also applies if the disk packaging contains a double set of software, for example one set of 3.5" floppy disks and a CD-ROM. It is further valid if the package contains several versions of software adapted to different operating systems. A multi-utilization of the software is only permitted when a multi-user license has been purchased. The number of further computer systems authorized for usage under a multi-user license is evident from and limited by that license.

2. It is permitted to produce one single copy disk of the software for back-up purposes only. Furthermore, it is permitted to copy the software onto the hard disk of one single computer. It is not permitted to duplicate the contents of the EPROMs and/or Flash-RAMs on the ICP Controller.

3. The permanent conferring (by sale or donation) of the software is permitted. The new proprietor must be registered with ICP vortex and must assume all rights and obligations resulting from this Software license agreement. Each and any other kind of transfer, especially leasing, is not permitted. Copies made by the first user for security reasons must be destroyed upon transfer.

4. It is not allowed to change the software in its functions or its appearance (especially trade mark, firm name and copyright reference) or to edit it in any other way. Neither is it permitted to de-compile or disassemble the software.

5. The enclosed software has been carefully copied on floppy disks and/or CD-ROM(s). However, if the floppy disks and/or CD-ROM(s) should prove to be faulty, ICP vortex will exchange them within 4 weeks from the date of purchase.

6. ICP vortex makes no warranties, express or implied, including without limitation the implied warranties of merchantability, functionality and fitness for a particular purpose. In particular, ICP vortex is not liable to you for any consequential, incidental or indirect damage arising out of the use of this product.

7. This agreement is subject to the laws of the Federal Republic of Germany. Place of jurisdiction for both parties is the domicile of ICP vortex Computersysteme GmbH.

A.4 General Information

The ICP Controller should be installed by an authorized ICP vortex distributor. Precondition for the safe installation is an anti-static work place (earthed mat on the table with wrist bands connected to an earth). ICP vortex does not take any responsibility for damage arising out of improper installation. This manual contains all the information available at the time it was written. Errors and/or incomplete information are possible. We are grateful for any ideas or suggestions for improvement. Additional information may be found in the information file **"README.TXT"** on the enclosed System Disk "DOS". Besides up-to-date information, this file also contains a list of all programs on the ICP System Disks.

The contents of the file README.TXT must be read before the ICP Controller is used for the first time. Output is possible on printer or screen.

This **User's Manual** explains the installation and the operation of the ICP Controller. For information on the use of the computer system and its operating system, please refer to the corresponding system manuals. A short list of recommended literature can be found in the appendix of this manual.

A.4.1 Unpacking the ICP Controller

Open the show box and take out the ICP Controller (leaving it in its anti-static bag), the disk package and this manual.
WARNING: Never take the GDT PCB (Printed Circuit Board) out of the anti-static bag unless this is done at an anti-static work place, and the person handling the ICP Controller is secured with wrist bands against electrostatic charge. If these instructions are not observed, the CMOS components on the ICP Controller may be damaged or destroyed.
Store the show box in a safe and dry place.

A.4.2 Delivery Contents

The following items are delivered with the ICP Controller:

1. ICP Controller in a sealed anti-static bag.
2. Sealed GDT CD/disk package with driver and installation disks and/or CD.
3. This User's Manual.

A.4.3 Contents of the GDT Driver Disks and/or CD

A list of the files delivered with GDT can be found in the file **README.TXT** on the enclosed GDT System Disk DOS or the ICP CD. The contents of this file can be viewed on screen or output on your printer. You should not use the GDT System Disks as your working disks. Use an appropriate utility program (for example DISKCOPY of MS-DOS) to make functional copies of all system disks (please observe the software license agreement). Store your original system disks in a safe and dry place.

A.4.4 Before You Start

In order to avoid damage caused by improper or faulty usage or handling, **we strongly recommend** reading this manual carefully before installation or first operation.

A.5 Product Description

A.5.1 Intel i960RD I/O Processor

The i960RD I/O processor is a member of a new RISC CPU generation which was specifically designed for I/O applications. This CPU on an ICP Controller can reach a performance of **40 MIPS** and supervises all tasks of the Fibre Channel / SCSI devices, the RAID controlling and the communication with the PCI computer. In doing so, it significantly offloads the PCI computer, leaving it free to perform its original tasks.

A.5.2 Architecture - General 32 BIT

To meet the demands on a high performance controller, the bus architecture of the ICP Controller has a general **32-bit** layout.

- 32-bit control processor (i960RD (TM) I/O Processor)
- 32-bit SCSI processors
- 32-bit bus-interface (PCI)
- 32-bit Cache RAM

A.5.3 Cache RAM - Expandable to 128MB

The cache RAM of a ICP Controller consists of one standard PS/2, 72 PIN, 32-bit or 36-bit, SIMM (**S**ingle **I**nline **M**emory **M**odule). This can be a Fast Page Mode (FPM) SIMM with an access time of 60ns (or less), or an Extended Data Out (EDO) SIMM with an access time of 50ns. Operation of the controller with an EDO SIMM increases the controller's overall performance.
The cache size is flexible as different memory sizes can be obtained by using different SIMMs. Thus, the memory can be expanded to 4MB, 8MB, 16MB, 32MB, 64MB or 128MB.
An intelligent multi-level cache algorithm ensures that a high hit rate (cache hit) is achieved. Both, look-ahead and special delayed-write cache functions are implemented.
With the GDT configuration program "GDTSETUP" and the monitoring utility GDTMON, the user can adjust various cache parameters.

A.5.4 Compatibility - PCI

The controllers of the GDT series have been developed in accordance with the 2.1 PCI-Bus specifications. They perform full bus-master DMA.

A.5.5 Up to 5 Wide/Ultra2 SCSI Channels & 1 Narrow/Ultra SCSI Channel

The ICP Controllers are available with up to five Wide/Ultra2 SCSI Channels. In addition all models have a Narrow/Ultra SCSI channel for legacy SCSI devices. Per Wide/Ultra2 SCSI Channel up to **15 Ultra2 SCSI devices** can be connected. The maximum data transfer rate is **80MB/sec on the Wide/Ultra2 SCSI Channel** and **20MB/sec on the Narrow/Ultra SCSI channel.**

The Wide/Ultra2 SCSI channels are equipped with a SE/LVDS (Low Voltage Differential Signaling) Termination, which has an automatic detection of SE or LVDS mode operation. The Narrow/Ultra SCSI channel has a SCSI-2-compliant (*alternative* 2), active termination. The termination of all SCSI channel is software-switchable. The Wide/Ultra2 SCSI channels allow for a separate termination of the lower and higher byte of the SCSI bus.

A.5.6 ICP Controller Firmware, PCI-BIOS and GDTSETUP

The firmware, the BIOS of the ICP Controller and the configuration program GDTSETUP are stored in a Flash-RAM on the ICP Controller PCB. The firmware is designed for parallel processing and it controls all resources of the ICP Controller. This means that the entire administration of SCSI devices and RAID is exclusively carried out by the ICP Controller. Thus, the host is significantly offloaded. In addition, this hardware-implemented solution guarantees the highest achievable security. The controller-BIOS provides a complete PCI compatible INT13 interface (with 8GB DOS-partition extension) and expands the respective functions of the system BIOS. It also ensures that operating systems using the INT13 (i.e. MS-DOS, OS/2) can be booted directly from a SCSI device / RAID Array Drive connected to the ICP Controller. According to the various product expansion levels of the GDT RP Series, two different firmware levels are available. Installed upon delivery are the

Standard-Firmware (RAID 0, 1)	in	GDT6118RD, GDT6128RD
RAIDYNE-Firmware (RAID 0, 1, 4, 5, 10)	in	GDT6518RD, GDT6528RD, GDT6538RD, GDT6558RD

A controller originally equipped with the Standard-Firmware can be easily upgraded by the user with the RAIDYNE-Firmware. The Standard-Firmware offers the RAID Levels 0 and 1. As controllers have the RAIDYNE-Firmware, RAID Levels 0, 1, 4, 5, 10 and security features such as H*ot Fix* or H*ot Plug* become available. RAIDYNE is also capable of performing an on-line capacity expansion of an existing array by adding one ore more new hard disks. During expansion the array is fully operational. Another feature of RAIDYNE is the online RAID Level Migration of an existing array, e.g., from RAID 0 to RAID 5.

A.5.7 Configuration Program GDTSETUP

GDTSETUP is either loadable from the Flash-RAM of the ICP Controller (press <CTRL><G> after the ICP shows the controller BIOS), or from the command prompt under MS-DOS. GDTSETUP has a graphical user interface. It provides besides others the following functions:

- Configuration of SCSI and Fibre Channel devices connected to the ICP Controller and administrated by the GDT cache. Devices not controlled by the cache (CD-ROM, DAT, DLT, WORM, MOD, etc.) are either operated by means of the ASPI interface, or are directly supported by the operating system.
- EXPRESS and ADVANCED configuration of single disks, or RAID 0, 1, 4, 5 and 10 Host Drives.
- Configuration of the ICP Controller's cache and intelligent fault bus.

A.5.8 Diagnosis Program GDTMON

The diagnosis program (or simply *monitor*) GDTMON (GDT MONitor) is a very flexible software tool that offers many different diagnosis and maintenance functions during full-operation conditions. GDTMON can be used on the fileserver, or remotely from an authorized workstation. The main functions of GDTMON are:

- Monitoring the disk subsystem performance (KB/sec and I/Os per sec.)
- Monitoring the utilization of the on-board GDT cache
- Online configuration of the GDT cache memory
- Online changes of device parameters
- Online check of the parity information of RAID 4 and RAID 5 Array Drives
- Online capacity expansion of existing Array Drives
- Hot Plug and Hot Fix

A.5.9 Operating System Driver Software

Drivers for the following operating systems are available:

Operating System	Driver included with the Controller Package
MS-DOS 3.3 to 6.x	Yes
Novell NetWare 3.11, 3.12, 4.x	Yes
SCO UNIX System V/386 3.2v5.x	Yes
Interactive UNIX V/386 3.2v3, 3.2v4	Yes
SCO UnixWare 2.x	Yes
IBM OS/2 2.x, Warp 3, Warp 4	Yes
Windows NT 3.5x, 4.x	Yes
Windows 95	Yes
Linux 1.2.13, 1.3.37, 1.3.97, 2.0.00, 2.0.18	Yes

The following table shows how various devices are integrated by different operating systems. Please refer to the corresponding chapters of this User's manual and the operating system documentation for detailed installation information.

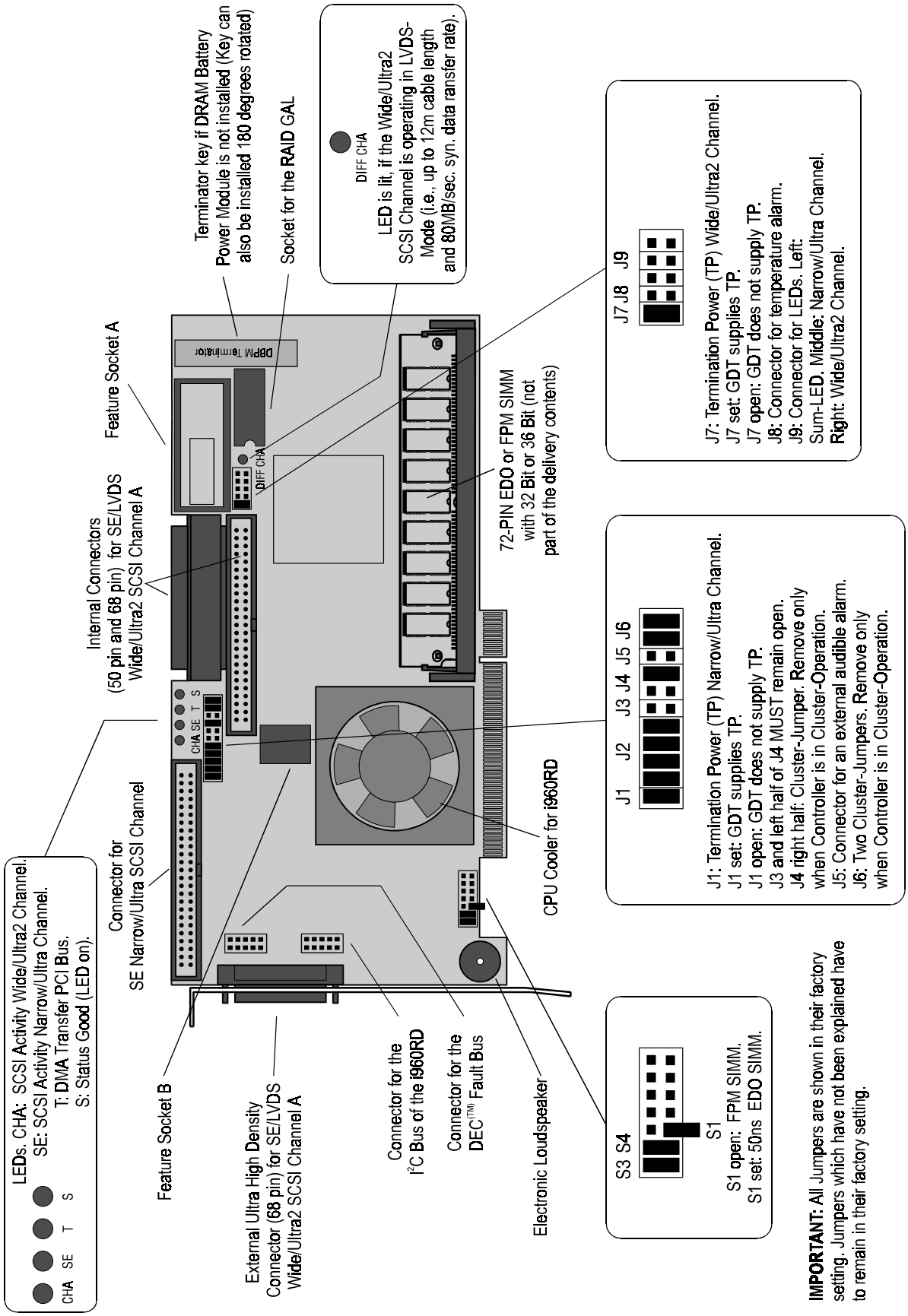
	Hard Disk	Remov. HDD	CD-ROM	Streamer	WORM	MOD
MS-DOS	GDT	ASPI or GDT	ASPI	ASPI	ASPI	ASPI/GDT
NetWare	GDT	GDT	ASPI	ASPI	ASPI	ASPI/GDT
UNIX	GDT	GDT	UNIX	UNIX	UNIX	UNIX/GDT
Win. NT	GDT	Win.NT or GDT	Win.NT	Win.NT	Win.NT	Win.NT
OS/2	GDT	OS/2 or GDT	ASPI	ASPI	ASPI	ASPI or GDT

GDT: Configurable with GDTSETUP (some MODs are recognized as a hard disk (see your MOD manual). In this case, they too can be configured with GDTSETUP). **ASPI:** Integration by means of an ASPI interface. **UNIX, OS/2, Win.NT:** Supported by the operating system.

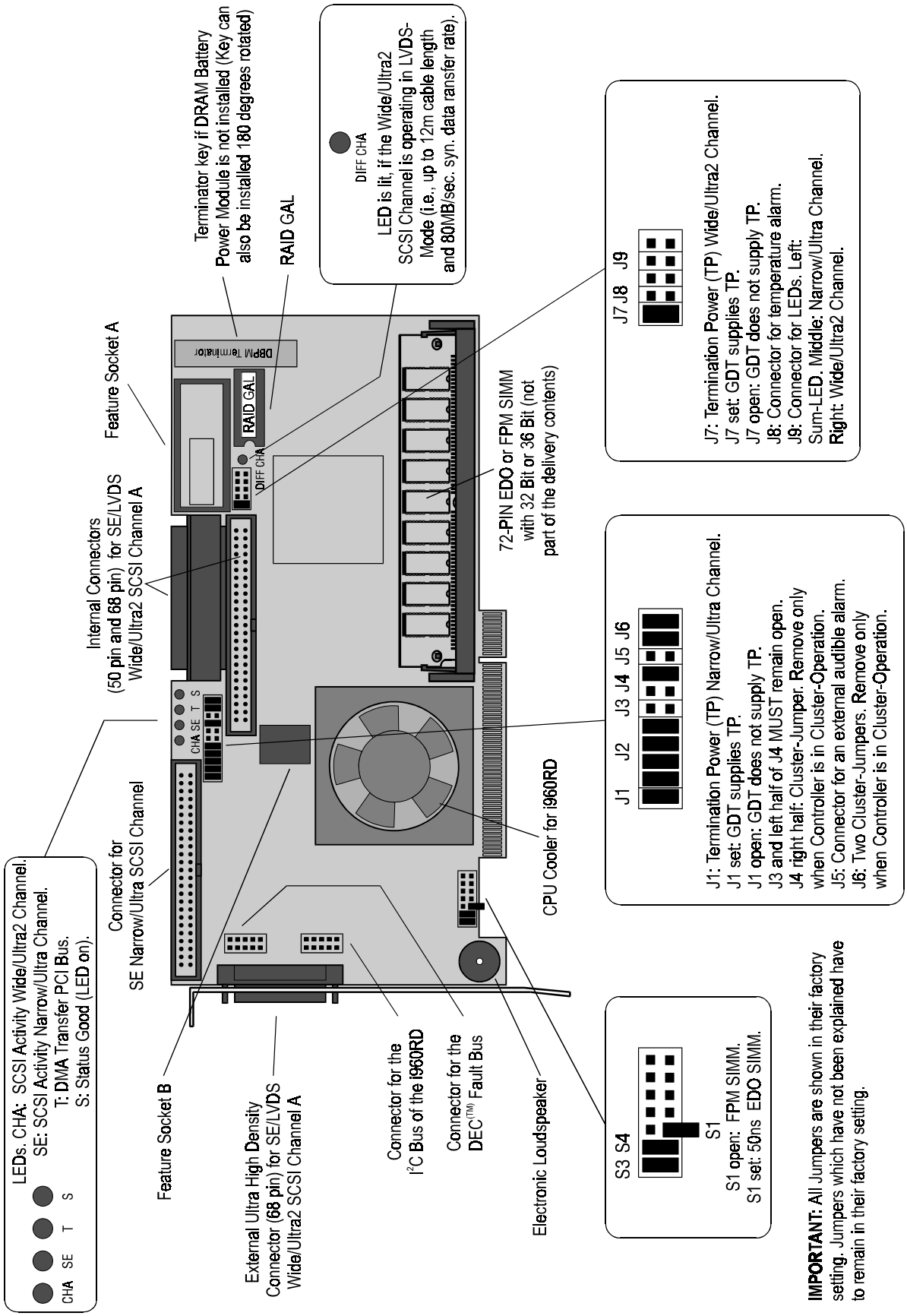
A.5.10 ICP Controller GDT RD Series Board Layout

The ICP Controller PCB (Printed Circuit Board) has several jumpers. In the following illustrations, all jumpers are shown in their factory setting. No other jumpers except the TP and S1 jumpers are user-serviceable and must remain in their displayed position. An installed TP jumper means that the ICP Controller supplies the termination power on the SCSI cable of the Wide/Ultra SCSI channel. The S1 Jumper has to be installed if the ICP Controller is operated with an EDO SIMM. For operation with a Fast Page Mode SIMM, the jumper must not be set.

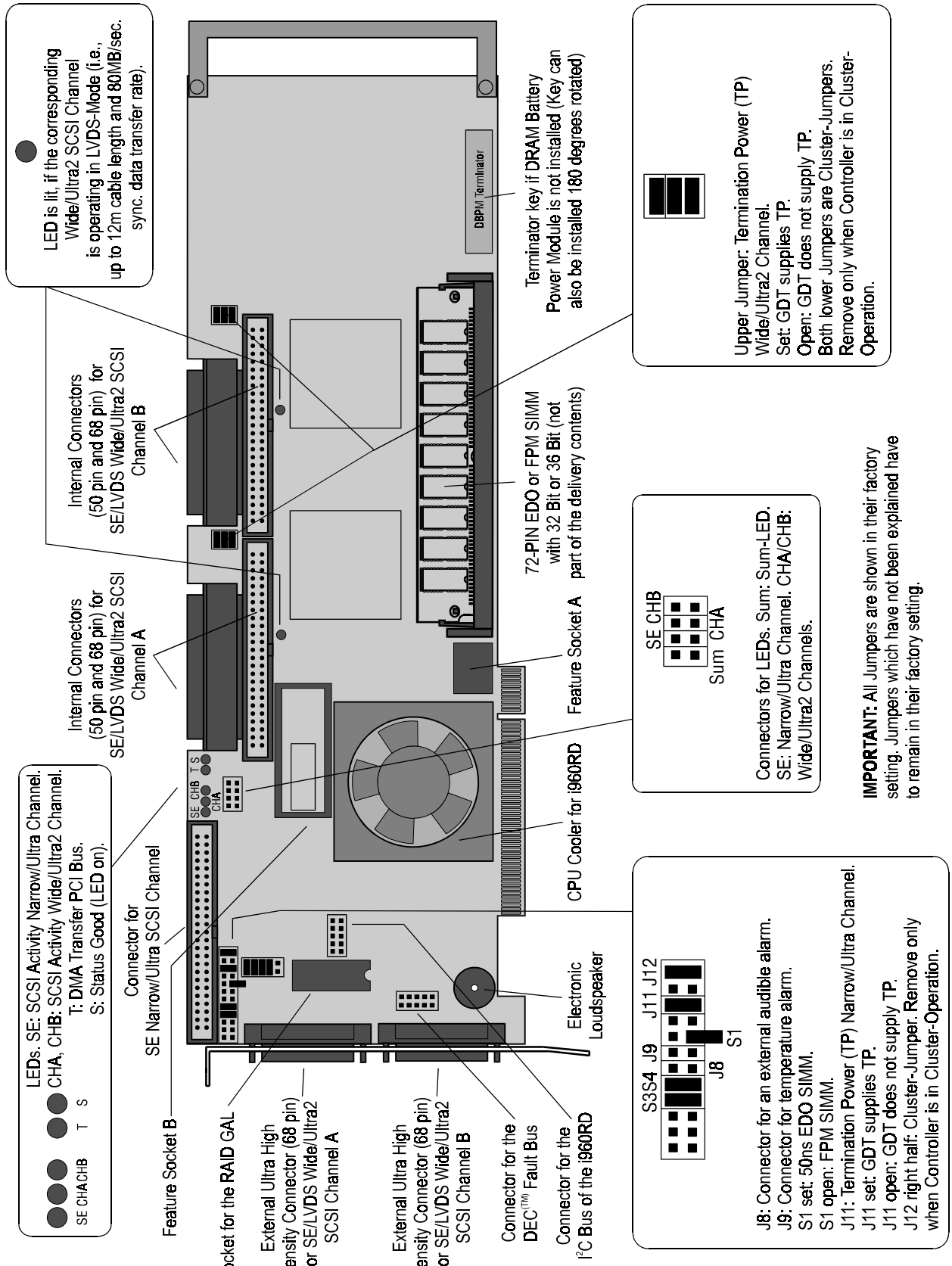
GDT6118RD Overall View


LEDs. CHA: SCSI Activity Wide/Ultra2 Channel.
SE: SCSI Activity Narrow/Ultra Channel.
T: DMA Transfer PCI Bus.
S: Status Good (LED on).
CHA SE T S
Internal Connectors
(50 pin and 68 pin) for SE/LVDS
Wide/Ultra2 SCSI Channel A
Feature Socket A
Terminator key if DRAM Battery
Power Module is not installed (Key can
also be installed 180 degrees rotated)
Socket for the RAID GAL
DIFF CHA
LED is lit, if the Wide/Ultra2
SCSI Channel is operating in LVDS-
Mode (i.e., up to 12m cable length
and 80MB/sec. syn. data ransfer rate).
DBPM Terminator
72-PIN EDO or FPM SIMM
with 32 Bit or 36 Bit (not
part of the delivery contents)
J7 J8 J9
J7: Termination Power (TP) Wide/Ultra2 Channel.
J7 set: GDT supplies TP.
J7 open: GDT does not supply TP.
J8: Connector for temperature alarm.
J9: Connector for LEDs. Left:
Sum-LED. Middle: Narrow/Ultra Channel.
Right: Wide/Ultra2 Channel.
J1 J2 J3 J4 J5 J6
J1: Termination Power (TP) Narrow/Ultra Channel.
J1 set: GDT supplies TP.
J1 open: GDT does not supply TP.
J3 and left half of J4 MUST remain open.
J4 right half: Cluster-Jumper. Remove only
when Controller is in Cluster-Operation.
J5: Connector for an external audible alarm.
J6: Two Cluster-Jumpers. Remove only
when Controller is in Cluster-Operation.
Connector for
SE Narrow/Ultra SCSI Channel
CPU Cooler for i960RD
Feature Socket B
External Ultra High Density
Connector (68 pin) for SE/LVDS
Wide/Ultra2 SCSI Channel A
Connector for the
I²C Bus of the i960RD
Connector for the
DEC(TM) Fault Bus
Electronic Loudspeaker
S3 S4
S1
S1 open: FPM SIMM.
S1 set: 50ns EDO SIMM.
IMPORTANT: All Jumpers are shown in their factory
setting. Jumpers which have not been explained have
to remain in their factory setting.

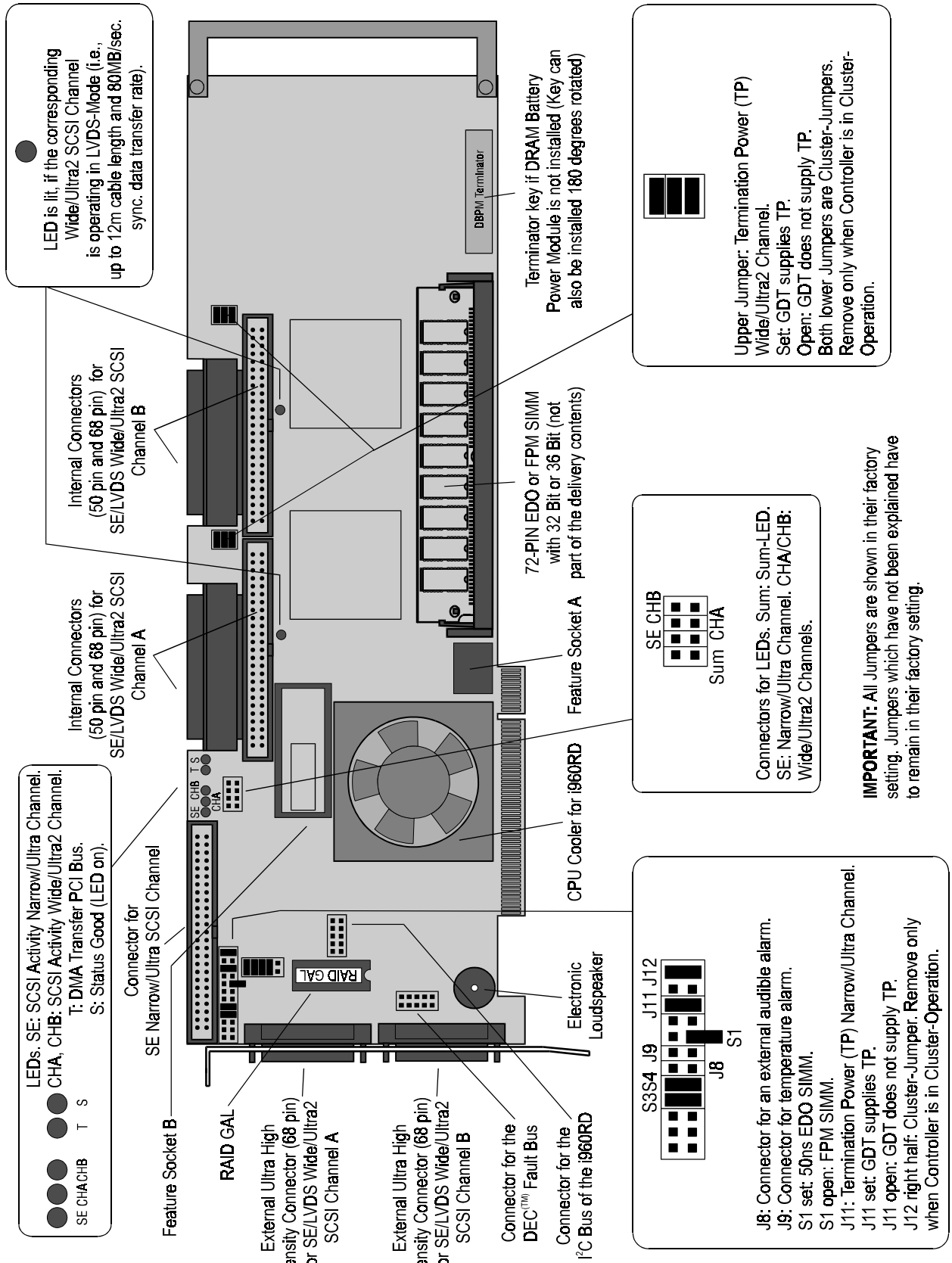
GDT6518RD Overall View


LEDs. CHA: SCSI Activity Wide/Ultra2 Channel.
SE: SCSI Activity Narrow/Ultra Channel.
T: DMA Transfer PCI Bus.
S: Status Good (LED on).
CHA SE T S
Terminator key if DRAM Battery Power Module is not installed (Key can also be installed 180 degrees rotated)
RAID GAL
DIFF CHA
LED is lit, if the Wide/Ultra2 SCSI Channel is operating in LVDS-Mode (i.e., up to 12m cable length and 80MB/sec. syn. data ransfer rate).
Feature Socket A
Internal Connectors (50 pin and 68 pin) for SE/LVDS Wide/Ultra2 SCSI Channel A
72-PIN EDO or FPM SIMM with 32 Bit or 36 Bit (not part of the delivery contents)
J7 J8 J9
J7: Termination Power (TP) Wide/Ultra2 Channel.
J7 set: GDT supplies TP.
J7 open: GDT does not supply TP.
J8: Connector for temperature alarm.
J9: Connector for LEDs. Left: Sum-LED. Middle: Narrow/Ultra Channel. Right: Wide/Ultra2 Channel.
Connector for SE Narrow/Ultra SCSI Channel
CPU Cooler for i960RD
J1 J2 J3 J4 J5 J6
J1: Termination Power (TP) Narrow/Ultra Channel.
J1 set: GDT supplies TP.
J1 open: GDT does not supply TP.
J3 and left half of J4 MUST remain open.
J4 right half: Cluster-Jumper. Remove only when Controller is in Cluster-Operation.
J5: Connector for an external audible alarm.
J6: Two Cluster-Jumpers. Remove only when Controller is in Cluster-Operation.
Feature Socket B
External Ultra High Density Connector (68 pin) for SE/LVDS Wide/Ultra2 SCSI Channel A
Connector for the I²C Bus of the i960RD
Connector for the DEC(TM) Fault Bus
Electronic Loudspeaker
S3 S4
S1
S1 open: FPM SIMM.
S1 set: 50ns EDO SIMM.
IMPORTANT: All Jumpers are shown in their factory setting. Jumpers which have not been explained have to remain in their factory setting.

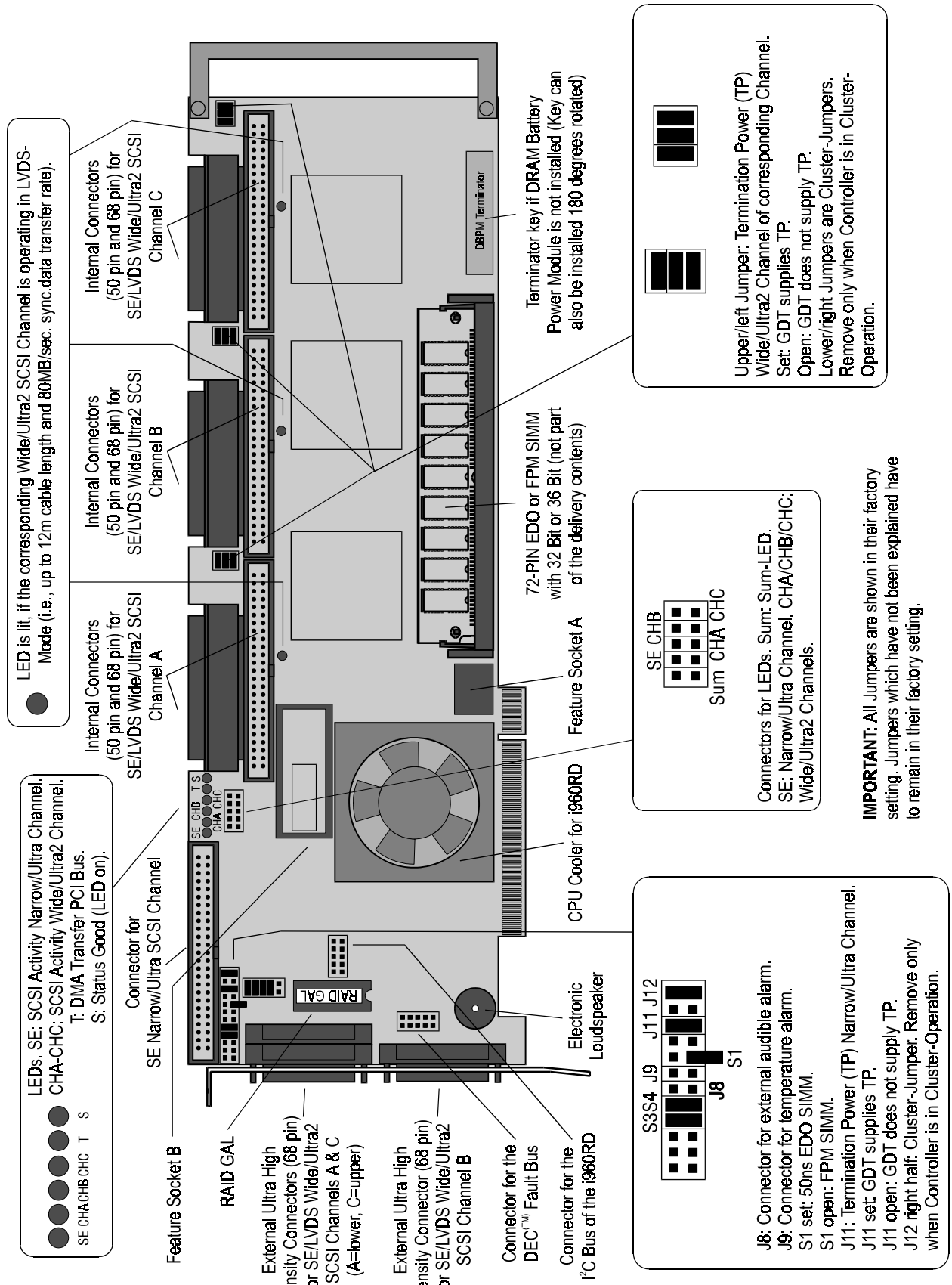
GDT6128RD Overall View


LED is lit, if the corresponding Wide/Ultra2 SCSI Channel is operating in LVDS-Mode (i.e., up to 12m cable length and 80MB/sec. sync. data transfer rate).
Internal Connectors (50 pin and 68 pin) for SE/LVDS Wide/Ultra2 SCSI Channel B
Internal Connectors (50 pin and 68 pin) for SE/LVDS Wide/Ultra2 SCSI Channel A
Terminator key if DRAM Battery Power Module is not installed (Key can also be installed 180 degrees rotated)
72-PIN EDO or FPM SIMM with 32 Bit or 36 Bit (not part of the delivery contents)
Feature Socket A
CPU Cooler for i960RD
Upper Jumper: Termination Power (TP) Wide/Ultra2 Channel.
Set: GDT supplies TP.
Open: GDT does not supply TP.
Both lower Jumpers are Cluster-Jumpers.
Remove only when Controller is in Cluster-Operation.
SE CHB
Sum CHA
Connectors for LEDs. Sum: Sum-LED.
SE: Narrow/Ultra Channel. CHA/CHB: Wide/Ultra2 Channels.
IMPORTANT: All Jumpers are shown in their factory setting. Jumpers which have not been explained have to remain in their factory setting.
LEDs. SE: SCSI Activity Narrow/Ultra Channel.
CHA, CHB: SCSI Activity Wide/Ultra2 Channel.
T: DMA Transfer PCI Bus.
S: Status Good (LED on).
SE CHA CHB T S
Connector for SE Narrow/Ultra SCSI Channel
Feature Socket B
Socket for the RAID GAL
External Ultra High Density Connector (68 pin) for SE/LVDS Wide/Ultra2 SCSI Channel A
External Ultra High Density Connector (68 pin) for SE/LVDS Wide/Ultra2 SCSI Channel B
Connector for the DEC(TM) Fault Bus
Connector for the I2C Bus of the i960RD
Electronic Loudspeaker
S3S4 J9 J11 J12
J8
S1
J8: Connector for an external audible alarm.
J9: Connector for temperature alarm.
S1 set: 50ns EDO SIMM.
S1 open: FPM SIMM.
J11: Termination Power (TP) Narrow/Ultra Channel.
J11 set: GDT supplies TP.
J11 open: GDT does not supply TP.
J12 right half: Cluster-Jumper. Remove only when Controller is in Cluster-Operation.
DBPM Terminator

GDT6528RD Overall View

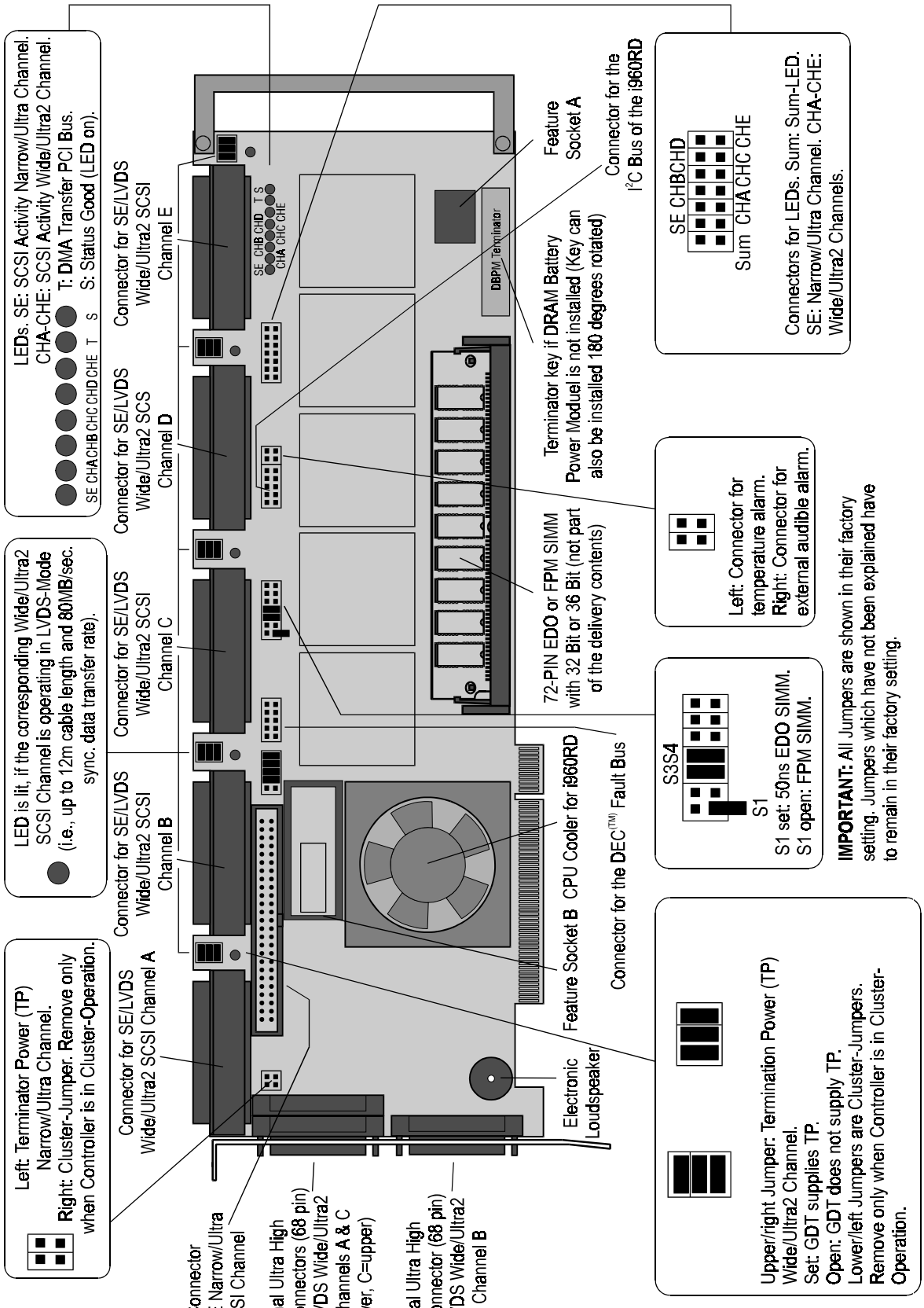

LED is lit, if the corresponding Wide/Ultra2 SCSI Channel is operating in LVDS-Mode (i.e., up to 12m cable length and 80MB/sec. sync. data transfer rate).
Internal Connectors (50 pin and 68 pin) for SE/LVDS Wide/Ultra2 SCSI Channel B
Internal Connectors (50 pin and 68 pin) for SE/LVDS Wide/Ultra2 SCSI Channel A
Terminator key if DRAM Battery Power Module is not installed (Key can also be installed 180 degrees rotated)
72-PIN EDO or FPM SIMM with 32 Bit or 36 Bit (not part of the delivery contents)
Feature Socket A
CPU Cooler for i960RD
Electronic Loudspeaker
LEDs. SE: SCSI Activity Narrow/Ultra Channel. CHA, CHB: SCSI Activity Wide/Ultra2 Channel. T: DMA Transfer PCI Bus. S: Status Good (LED on).
SE CHA CHB T S
Connector for SE Narrow/Ultra SCSI Channel
Feature Socket B
RAID GAL
External Ultra High Density Connector (68 pin) for SE/LVDS Wide/Ultra2 SCSI Channel A
External Ultra High Density Connector (68 pin) for SE/LVDS Wide/Ultra2 SCSI Channel B
Connector for the DEC(TM) Fault Bus
Connector for the I²C Bus of the i960RD
DBPM Terminator
Upper Jumper: Termination Power (TP) Wide/Ultra2 Channel.
Set: GDT supplies TP.
Open: GDT does not supply TP.
Both lower Jumpers are Cluster-Jumpers.
Remove only when Controller is in Cluster-Operation.
SE CHB
Sum CHA
Connectors for LEDs. Sum: Sum-LED.
SE: Narrow/Ultra Channel. CHA/CHB: Wide/Ultra2 Channels.
IMPORTANT: All Jumpers are shown in their factory setting. Jumpers which have not been explained have to remain in their factory setting.
S3S4 J9 J11 J12
J8
S1
J8: Connector for an external audible alarm.
J9: Connector for temperature alarm.
S1 set: 50ns EDO SIMM.
S1 open: FPM SIMM.
J11: Termination Power (TP) Narrow/Ultra Channel.
J11 set: GDT supplies TP.
J11 open: GDT does not supply TP.
J12 right half: Cluster-Jumper. Remove only when Controller is in Cluster-Operation.

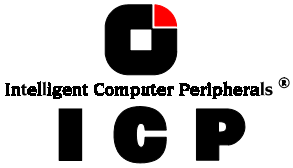
GDT6538RD Overall View


LEDs. SE: SCSI Activity Narrow/Ultra Channel.
CHA-CHC: SCSI Activity Wide/Ultra2 Channel.
T: DMA Transfer PCI Bus.
S: Status Good (LED on).
SE CHA CHB CHC T S
LED is lit, if the corresponding Wide/Ultra2 SCSI Channel is operating in LVDS-Mode (i.e., up to 12m cable length and 80MB/sec. sync.data transfer rate).
Internal Connectors (50 pin and 68 pin) for SE/LVDS Wide/Ultra2 SCSI Channel A
Internal Connectors (50 pin and 68 pin) for SE/LVDS Wide/Ultra2 SCSI Channel B
Internal Connectors (50 pin and 68 pin) for SE/LVDS Wide/Ultra2 SCSI Channel C
DBPM Terminator
Terminator key if DRAM Battery Power Module is not installed (Key can also be installed 180 degrees rotated)
72-PIN EDO or FPM SIMM with 32 Bit or 36 Bit (not part of the delivery contents)
Feature Socket A
CPU Cooler for i960RD
Electronic Loudspeaker
Connector for SE Narrow/Ultra SCSI Channel
Feature Socket B
RAID GAL
External Ultra High Density Connectors (68 pin) for SE/LVDS Wide/Ultra2 SCSI Channels A & C (A=lower, C=upper)
External Ultra High Density Connector (68 pin) for SE/LVDS Wide/Ultra2 SCSI Channel B
Connector for the DEC(TM) Fault Bus
Connector for the I²C Bus of the i960RD
SE CHB
Sum CHA CHC
Connectors for LEDs. Sum: Sum-LED.
SE: Narrow/Ultra Channel. CHA/CHB/CHC: Wide/Ultra2 Channels.
Upper/left Jumper: Termination Power (TP) Wide/Ultra2 Channel of corresponding Channel.
Set: GDT supplies TP.
Open: GDT does not supply TP.
Lower/right Jumpers are Cluster-Jumpers.
Remove only when Controller is in Cluster-Operation.
S3S4 J9 J11 J12
J8
S1
J8: Connector for external audible alarm.
J9: Connector for temperature alarm.
S1 set: 50ns EDO SIMM.
S1 open: FPM SIMM.
J11: Termination Power (TP) Narrow/Ultra Channel.
J11 set: GDT supplies TP.
J11 open: GDT does not supply TP.
J12 right half: Cluster-Jumper. Remove only when Controller is in Cluster-Operation.
IMPORTANT: All Jumpers are shown in their factory setting. Jumpers which have not been explained have to remain in their factory setting.

Intelligent Computer Peripherals ®
ICP

GDT6558RD Overall View

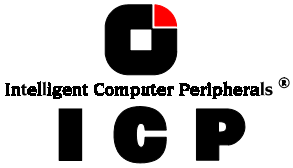

LEDs. SE: SCSI Activity Narrow/Ultra Channel.
CHA-CHE: SCSI Activity Wide/Ultra2 Channel.
SE CHA CHB CHC CHD CHE T S
T: DMA Transfer PCI Bus.
S: Status Good (LED on).
LED is lit, if the corresponding Wide/Ultra2 SCSI Channel is operating in LVDS-Mode (i.e., up to 12m cable length and 80MB/sec. sync. data transfer rate).
Left: Terminator Power (TP) Narrow/Ultra Channel.
Right: Cluster-Jumper. Remove only when Controller is in Cluster-Operation.
Connector for SE/LVDS Wide/Ultra2 SCSI Channel A
Connector for SE/LVDS Wide/Ultra2 SCSI Channel B
Connector for SE/LVDS Wide/Ultra2 SCSI Channel C
Connector for SE/LVDS Wide/Ultra2 SCS Channel D
Connector for SE/LVDS Wide/Ultra2 SCSI Channel E
SE CHB CHD T S
CHA CHC CHE
DBPM Terminator
Terminator key if DRAM Battery Power Moduel is not installed (Key can also be installed 180 degrees rotated)
Feature Socket A
Connector for the I²C Bus of the i960RD
SE CHB CHD
Sum CHA CHC CHE
Connectors for LEDs. Sum: Sum-LED. SE: Narrow/Ultra Channel. CHA-CHE: Wide/Ultra2 Channels.
72-PIN EDO or FPM SIMM with 32 Bit or 36 Bit (not part of the delivery contents)
Left: Connector for temperature alarm.
Right: Connector for external audible alarm.
S3S4
S1
S1 set: 50ns EDO SIMM.
S1 open: FPM SIMM.
IMPORTANT: All Jumpers are shown in their factory setting. Jumpers which have not been explained have to remain in their factory setting.
Connector for the DEC(TM) Fault Bus
Feature Socket B CPU Cooler for i960RD
Electronic Loudspeaker
Upper/right Jumper: Termination Power (TP) Wide/Ultra2 Channel.
Set: GDT supplies TP.
Open: GDT does not supply TP.
Lower/left Jumpers are Cluster-Jumpers.
Remove only when Controller is in Cluster-Operation.
Connector for SE Narrow/Ultra SCSI Channel
External Ultra High Density Connectors (68 pin) for SE/LVDS Wide/Ultra2 SCSI Channels A & C (A=lower, C=upper)
External Ultra High Density Connector (68 pin) for SE/LVDS Wide/Ultra2 SCSI Channel B


Intelligent Computer Peripherals ®
ICP

Chapter B

Hardware

Installation



B. Hardware Installation

B.1 Before Installation

The ICP Controller is designed for minimum power consumption and maximum operational security. It therefore contains delicate electrical components (CMOS). In order to avoid damages caused by electrostatic charges, the following warning must be observed during installation:
Never take the ICP Controller out of the anti-static bag unless this is done at an anti-static work place and the person handling the ICP Controller is secured against electrostatic charge through wrist bands. If these instructions are not observed, the user risks damage or destruction of the CMOS components of the ICP Controller !

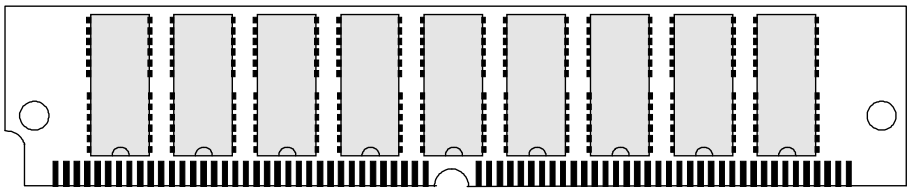
B.2 Tools

Before installing, please switch off the complete computer system and remove all cables including the power cable. Open the case of the host computer with an appropriate screwdriver (usually a medium sized Philips screwdriver).

B.3 Installing the Cache RAM SIMM

It is not possible to operate the ICP Controller without Cache-RAM. The ICP Controller is delivered without RAM (0MB).

If the ICP Controller is not yet equipped with cache RAM, or if another SIMM is to be installed, we recommend adding it before you install the ICP Controller in your computer system. As mentioned before, the ICP Controller can be run with different cache RAM sizes.



The minimum cache RAM size is 4MB. The maximum cache RAM size is 128MB. The ICP Controller provides one socket for a standard 72 PIN SIMM (Single Inline Memory Module). The SIMM can either have parity (=36 Bit), or non-parity (=32 Bit). The ICP Controller's memory controller can use a ***Fast Page Mode* (FPM)** SIMM with 60ns (or less) or an ***Extended Data Out* (EDO)** SIMM with 50ns. The use of an EDO SIMM increases the performance of the ICP Controller. The SIMM is correctly plugged into the SIMM socket if it is engaged correctly into the socket's metal hooks and if all contacts of the SIMM are equally contacting the corresponding pins of the socket.

Automatic Cache RAM Recognition
Each time you switch on the computer system, the ICP Controller automatically recognizes how much cache RAM is available and configures itself accordingly.

Recommended SIMM Manufacturers
SIMMs from Goldstar, Motorola, NEC, Samsung, Siemens, Texas Instruments, and Toshiba have been successfully tested with the ICP Controllers. This recommendation does not imply an evaluation of quality. SIMMs from other manufacturers may be equally suitable. You can use single- and double-sided SIMMs. When using double-sided SIMMs with high power consumption special care should be taken that both, the ICP Controller and SIMM are properly cooled.

SIMM sizes and types which can be used on the ICP Controller :

Fast Page Mode* (FPM) SIMM, 60ns (*or less*), *Jumper* S1 *not set	***Extended Data Out* (EDO) SIMM, 50ns (*), *Jumper* S1 *set***	**RAM *Size***
1M*32 and 1M*36	1M*32 and 1M*36	4MB
2M*32 and 2M*36	2M*32 and 2M*36	8MB
4M*32 and 4M*36	4M*32 and 4M*36	16MB
8M*32 and 8M*36	8M*32 and 8M*36	32MB
16M*32 and 16M*36	16M*32 and 16M*36	64MB
32M*32 and 32M*36	32M*32 and 32M*36	128MB

(*) When using an EDO SIMM on the ICP Controller, jumper S1 has to be set (see last pages of chapter A). For the operation of a Fast Page Mode SIMM S1 must remain open. We have tested several EDO SIMMs with 60ns without any problems, but according to the specification of the ICP Controller's Intel i960 CPU, 50ns are necessary to comply with the timing requirements.

Obviously, the question arising at this point is: **"*How much cache* RAM *do* I *need* ?"**
In the following table, we made RAM equipment suggestions for the minimum, typical and optimum RAM size (Note: Naturally, all ICP Controllers work flawless with the smallest RAM size stated in column 2 of this table).

Controller	***Possible* SIMMs *in* [MB]**	**SIMM *equipment***		
		Minimum	***Typical***	***Optimum***
GDT6118RD GDT6128RD	4,8,16,32,64,128	8	16	32
GDT6518RD GDT6528RD GDT6538RD GDT6558RD	4,8,16,32,64,128	8	16	64

B.4 SCSI - Basics

Whoever has been involved with the subject of SCSI will have noticed that the "Small Computer System Interface" is an extremely interesting technology, which has become widely accepted in comparison to other interface models and has constantly adapted to the needs of customers. This builds up confidence and (investment) security. Last but not least, SCSI has remained the de facto I/O interface for smaller to mid-sized mass storage systems in the field of business.
The innovating factors are and were; downward compatibility (connector, protocols), the bandwidth (10MB/sec., 20MB/sec., 40MB/sec., 80MB/sec.) and the cable length (3 Meters to 12 Meters). The following table gives you an overview on the various development steps:

	"Fast SCSI" (FAST-10)		"Ultra SCSI" (FAST-20)		"Ultra2 SCSI" (FAST-40)	
	8 Bit Narrow	16 Bit Wide	8 Bit Narrow	16 Bit Wide	8 Bit Narrow	16 Bit Wide
Max. Transfer-rate [MB/sec.]	10	20	20	40	40	80
Max. Number Devices	7	15	7	15	7	15
Bus-Type	SE	SE	SE	SE	LVDS	LVDS
Cable length [Meter]	3	3	1.5	1.5	12	12
Connectors	50 pin	68 pin	50 pin	68 pin	50 pin	68 pin

We differentiate in the SCSI field between Single Ended (SE) and differential buses .
(Note: The above listed table does not show differential Bus-Types for Fast-SCSI..)

Single ended buses have the disadvantage that they are highly susceptible to distortion and therefore have to be shorter than differential buses. In SE environments, logical information is represented in terms of voltage levels on a wire. Therefore, small distortions can change the voltage level significantly which results in transmission errors. The current levels on the SE bus are reasonably higher than on a differential bus.
If the differential data transfer method is used, two wires with separate voltage levels are used per signal. Only the voltage difference between the wires represents the logical information. Because distortion has the same effect on both wires, it is automatically deleted during calculation of the difference. In this way, much longer cables with higher transfer rates are possible than in SE systems.
Differential SCSI has existed for a long time. However, it has always played a somewhat exotic role as the SCSI Controller and also the disks had to be differential and could only be operated in this way. Single Ended devices could and were not allowed to be used.

The Wide/Ultra2 SCSI ICP Controllers integrate the new Ultra2 SCSI technology. The idea behind Ultra2 SCSI is to develop SCSI devices (Controller and hard disks), which are able to work with one and the same connector in SE-Mode as well as in differential mode without the need for additional hardware. However, a SCSI Bus can be operated either in SE or differential mode, but not both at the same time. The Ultra2 Spec requires that SCSI devices „running“ in differential mode automatically switch to SE mode if they recognise that a pure SE device is connected to the cable.
The so-called LVDS - Low Voltage Differential Signaling - was chosen as the differential transfer technology for Ultra2 SCSI. LVDS is treated completely independently from SCSI and is defined via an ANSI and IEEE Norm. At present LVDS is also used for transferring video data etc.

In LVDS-Mode, an SE signal wire and its associated SE ground wire (GND) build a differential pair. Therefore, please take care when choosing an external round cable. It has to be explicitly designed for LVDS. Very often all GND wires are put together in the connector. These kinds of cables must not be used for LVDS.

- 80MB/sec. synchronous data transfer rates
- Up to 12 Meters cable length
- Compatibility to Ultra SCSI and FAST SCSI devices

The Wide/Ultra2 ICP Controllers of the RD Series are available with 1, 2, 3 or 5 completely independent Wide/Ultra2 SCSI channels. Each channel can control up to 15 Wide/Ultra2 SCSI devices.
In addition all Wide/Ultra2 ICP Controllers of the RD Series have a separate Narrow/Ultra SCSI Channel for legacy SE SCSI devices (hard disks, CD-ROMs, DLTs, DATs, etc.).
SE SCSI devices of a certain installation should be operated with this channel. Thus, the valuable Wide/Ultra2 SCSI channels are free for real Ultra2 SCSI devices (as soon as a SE SCSI device is operated with a Wide/Ultra2 channel, the channel is automatically switched to SE).

It is very important for you to observe the information and notes given in this section of the User's Manual because it helps to ensure that the SCSI devices that are used in connection with the ICP Controllers are operated in a successful, long-lasting and trouble-free manner. In many cases, this information is not only applicable to ICP Controllers, but in general to all those SCSI systems which, like the ICP Controllers, use Wide/Ultra2 technology. According to its definition, the SCSI bus provides access to several participants that are physically connected through an appropriate SCSI bus cable. To achieve a sufficiently good signal quality, it is not only recommended to use very good cables and connectors, but also to terminate both ends of the cable properly. For an unambiguous identification on the bus, all participants have a unique number – the so-called SCSI-ID. Further details on these topics can be found on the following pages.
Please note that **98% of all SCSI-related problems are caused by bad SCSI cables, wrong SCSI bus termination and duplicate SCSI-IDs.**

B.4.1 SCSI Cables

The quality and overall length of the cable, as well as the number and quality of the SCSI connectors is very important for both internal and external SCSI cables. Generally, internal SCSI cables are 50 or 68 conductor flat ribbon cables. To connect external SCSI devices, round and shielded cables with appropriate connectors are typically used. External round cables should have a SCSI-compliant placement of the inside conductors and should be approved for LVDS operation. Besides the cables, the right connectors for a cable are also very important. It is highly recommend to use highest quality connectors, only.

The following table shows the maximum cable lengths allowed for a given transfer rate. Based on many years of SCSI experience, the lengths we recommend are in some cases shorter than theoretically possible. The information in the table refers to one SCSI channel and represent the overall length of the cable, including internal and external parts.

SCSI Bus Width	SCSI Mode	Bus-Type	Synchronous Data Transfer Rate	Number of devices	Max. Cable Length
8 Bit, narrow	Fast	SE	10 MB/sec.	7	2.0 meters
8 Bit, narrow	Fast-20, Ultra	SE	20 MB/sec.	4	1.5 meters
8 Bit, narrow	Fast-40, Ultra2	LVDS	40 MB/sec.	7	12 meters

16 Bit, wide	Fast	SE	20 MB/sec.	15	2.0 meters
16 Bit, wide	Fast-20, Ultra	SE	40 MB/sec.	4	1.5 meters
16 Bit, wide	Fast-40, Ultra2	LVDS	80 MB/sec.	15	12 meters

In addition to specifications mentioned above, the following should be kept in mind when selecting and installing SCSI cables:

- Always install SCSI cables that are as short as possible. The lengths in the table above are absolute maximum lengths. (Total length of internal and external cables per channel).

- Avoid using SCSI cables with more connectors than actually needed. Never select a SCSI mode or operate a SCSI device with a cable that is not appropriate for this mode.

- The minimum distance between two connectors of a SCSI cable is 20 cm.

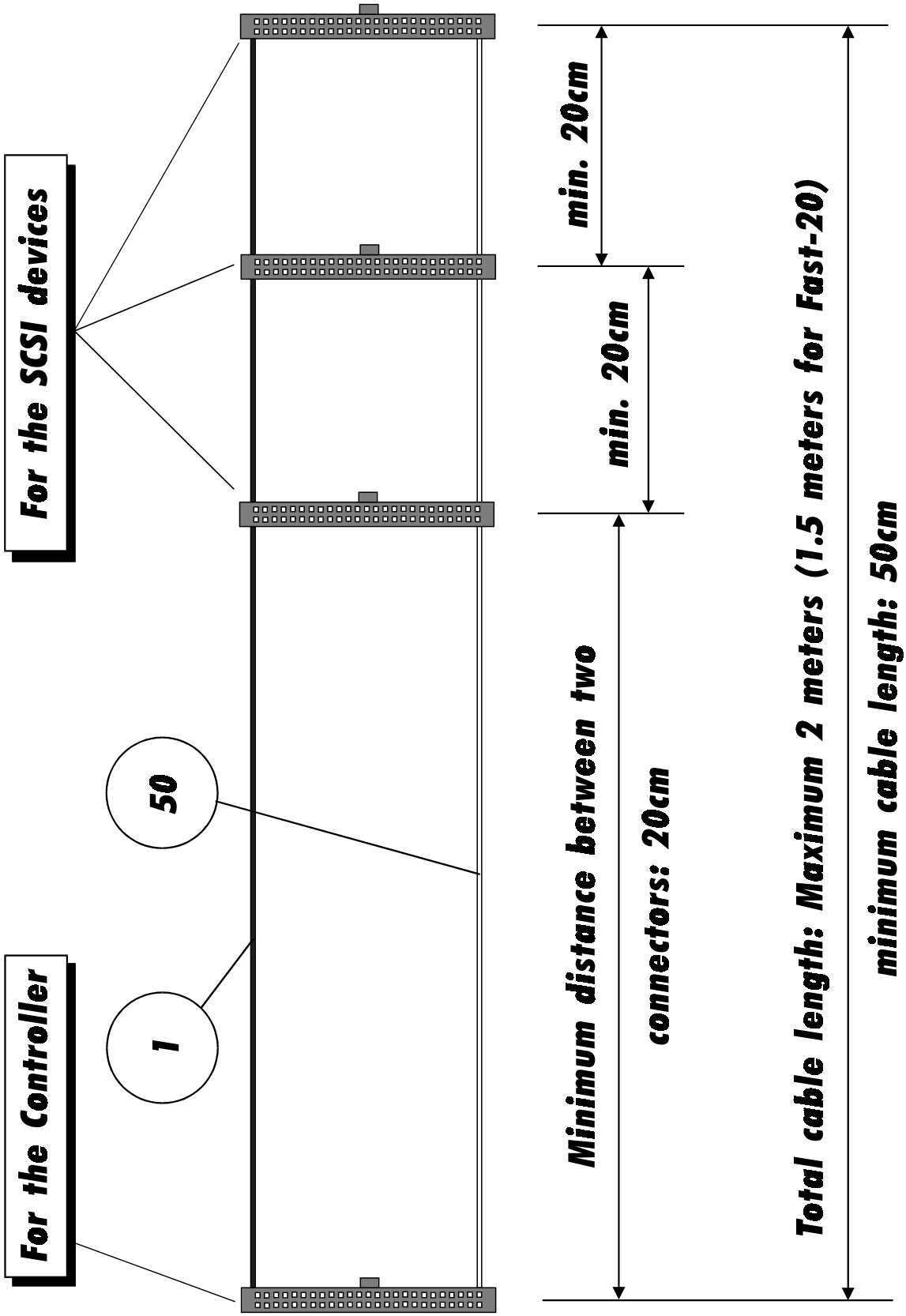
- Avoid cable stubs. If this is not possible, keep the stub length below 10 cm.
  "Star cablings" are not allowed.

- Keep the number of transitions from flat to round cables and vice versa as small as possible. It is usually best is to use flat or round cables, only.

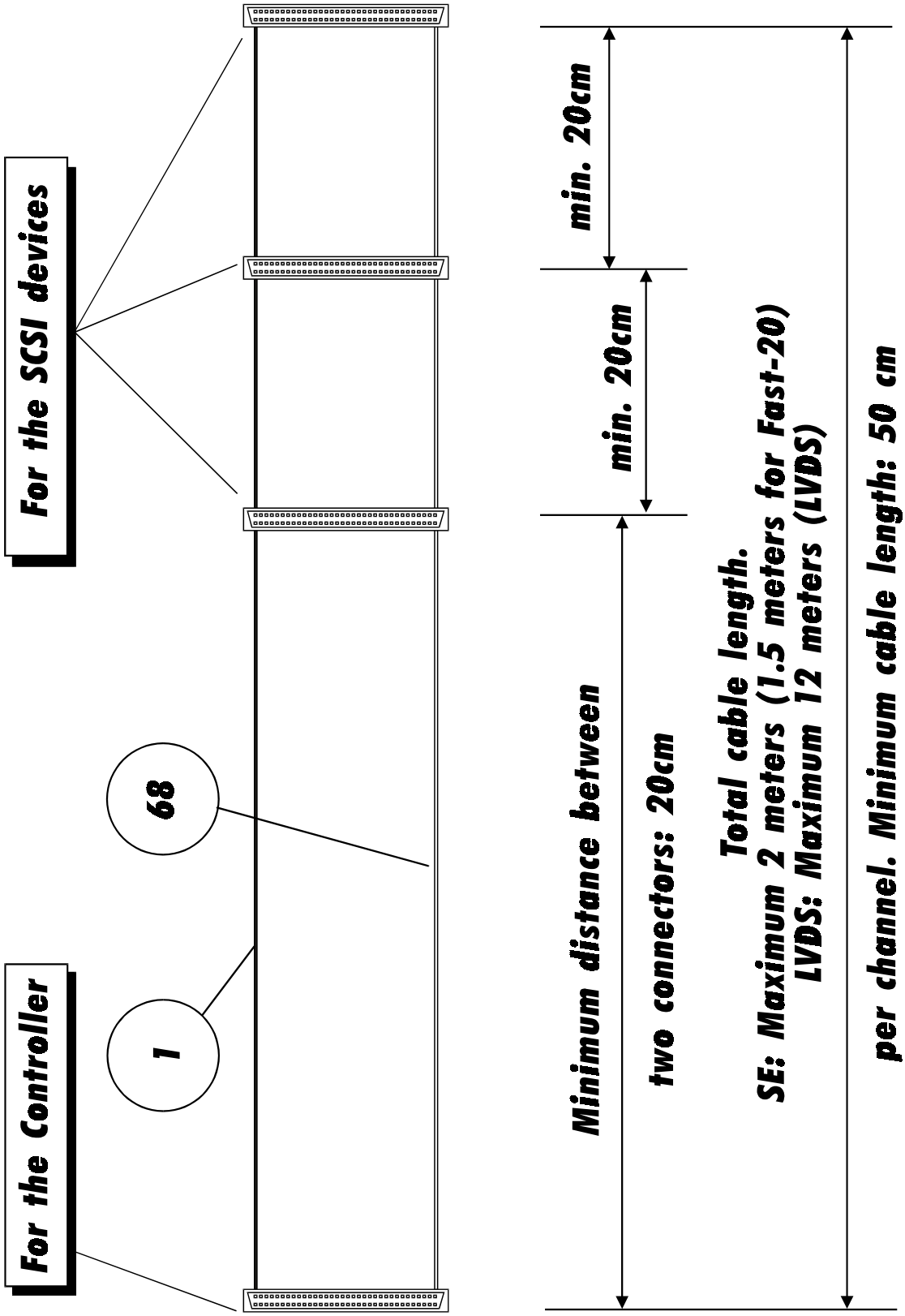
- Check these points when routing SCSI cables:
  - Avoid kinks in the SCSI cable
  - Do not roll the SCSI cable up on itself
  - Avoid routing the cable next to other cables
  - Avoid routing the cable in the vicinity of noise sources such as power supplies
  - Avoid routing the cable over sharp edges and in areas where it could get caught up
  - Avoid routing/sticking the cable directly onto metal surfaces

When making home-made SCSI cables, make sure that the insulation displacement connectors are properly aligned and firmly pressed into the flat ribbon cable. Otherwise, the whole cable might turn out to be a big short-circuit. Furthermore, check carefully that PIN 1 of the cable connects to PIN 1 of the connectors. A simple short-circuit and continuity test before running the devices helps you to save time and money.
The same warnings as for home-made cables apply when you buy non-brand cables. If you plan to run Fast-20 (Ultra) or Fast-40 (Ultra2) devices, you should explicitly ask your dealer if these cables are appropriate for the desired mode. (Note: The ICP product range also includes some high quality SCSI accessories. Please see section B.4.4 of this User's Manual or check our Website: http://www.icp-vortex.com, for further details).

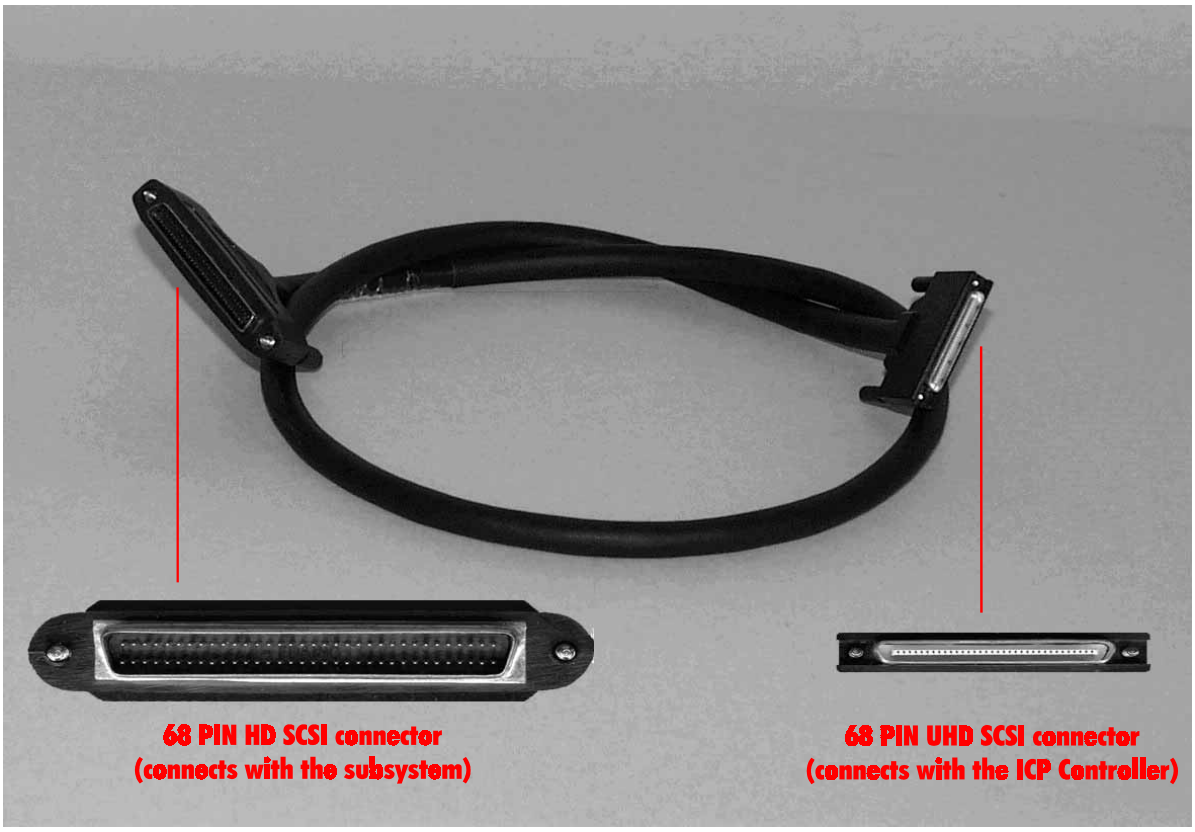
Example for a SCSI Flat Ribbon Cable for 8 Bit SCSI Devices (narrow)



Example for a SCSI Flat Ribbon Cable for 16 Bit SCSI Devices (wide)



Example for external Wide/Ultra2 cables (1 Meters and 4 Meters)



B.4.2 SCSI Termination

In order to ensure a flawless and interference-free signal transmission on the SCSI bus and to minimize the detrimental effects of external noise generators, both ends of the SCSI cable have to be terminated. The SCSI specification prescribes different termination methods for SE and LVDS SCSI bus systems.

There are two alternative termination modes for Single-Ended SCSI bus systems: The passive termination and the active termination, also known as Alternative-2 termination. The passive termination consists of a 220 Ohm pull-up and a 330 Ohm pull-down resistor for each signal. Today, the passive termination is mostly used in systems with synchronous data transfer rates not exceeding 5 MB/sec, which is rather slow. The active termination circuit consists of a 110 Ohm precision-resistor per signal and a common 2.85 Volt voltage regulator. Thus, all signals are actively pulled up to a certain level. The active termination provides much better signal quality and significantly reduced liability to noise.

LVDS SCSI bus systems allow only active LVDS termination. The termination circuitry must automatically recognize, if the bus is operated in SE or LCDS mode and adjust itself accordingly.

All Wide/Ultra2 SCSI channels of the ICP Controllers are equipped with a LVDS compliant termination. The additional Narrow/Ultra SCSI channel uses an active SCSI bus termination. The voltage for the termination circuitry is supplied either by the SCSI device itself, or by the TERMPWR line(s) of the SCSI bus.

Most of the new Wide/Ultra2 SCSI devices are delivered without termination. I.e., the SCSI bus cannot be terminated on the last device of the bus, but needs an external termination which allows SE and LVDS operation (see B.4.4 "ICP SCSI Accessories").

- Always use active SCSI bus termination.
- Do not use SCSI devices with passive SCSI bus termination (e.g., CD-ROMs) for the termination of the SCSI cable.
- Always terminate only the two ends of a SCSI cable.
- The TERMPWR jumpers on the ICP Controller PCB should always be set.

With regard to a proper termination in SCSI configurations comprising of ICP Controllers, SCSI devices, and SCSI cables, it is appropriate to go into further detail.
This already difficult topic is further complicated by the multi-connector systems of the ICP Controllers. ICP provides on various models an internal standard 50 pin header, an internal 68 pin receptacle and an external 68 pin UHD connector. This is an enormous advantage of ICP products; firstly, because you do not have to spend your money on expensive adapters, second, because it offers you more connections. The only secure way of finding out which particular connector to use and which terminator to enable is by analyzing the table below.

Note: To enable the option ***Auto***, or toggle between the **ON** and **OFF** termination settings for a ICP Controller SCSI channel, use the *Configure Controller* menu in GDTSETUP.
The connections listed in the table below are ***the only valid*** connections allowed. Any other connection setup, even if physically possible, is not allowed as it will cause serious malfunctions or even the destruction of the SCSI devices and/or the ICP Controller.

GDT6118RD, GDT6518RD, GDT6128RD, GDT6528RD, GDT6538RD

Valid connections and required GDTSETUP settings for the Wide/Ultra2 SCSI Channels.

External UHD Connector, 68 pin	Internal 68 pin Connector	Internal 50 pin Connector	Termination
Occupied and end terminated	Occupied and end terminated	Not occupied	Off or Auto
Occupied and end terminated	Not occupied	Not occupied	On or Auto
Occupied and end terminated	Not occupied	Occupied and end terminated	Off or Auto
Not occupied	Occupied and end terminated	Occupied and end terminated	Off or Auto
Not occupied	Not occupied	Occupied and end terminated	On or Auto
Not occupied	Not occupied	Occupied and both ends terminated, i.e., channel connector is located between the two ends	Off
Not occupied	Occupied and end terminated	Not occupied	On or Auto
Not occupied	Occupied and both ends terminated, i.e., channel connector is located between the two ends	Not occupied	Off
Not occupied	Not occupied	Not occupied	On or Auto

Valid connections and required GDTSETUP settings for the Narrow/Ultra SCSI Channel (Remark: The ICP firmware always assigns the Narrow/Ultra SCSI Channel as the last channel number).

50 pin Connector	Termination
Not occupied	On
Occupied and end terminated	On
Occupied and both ends terminated, i.e., channel connector is located between the two ends	Off

GDT6558RD

Valid connections and required GDTSETUP settings for the Wide/Ultra2 SCSI Channels A, B and C.

External UHD Connector, 68 pin	Internal 68 pin Connector	Termination
Occupied and end terminated	Occupied and end terminated	Off or Auto
Occupied and end terminated	Not occupied	On or Auto
Not occupied	Occupied and end terminated	On or Auto
Not occupied	Not occupied	On or Auto
Not occupied	Occupied and both ends terminated, i.e., channel connector is located between the two ends	Off

Valid connections and required GDTSETUP settings for the Wide/Ultra2 SCSI Channels D and E.

Internal 68 pin Connector	Termination
Not occupied	On
Occupied and end terminated	On
Occupied and both ends terminated, i.e., channel connector is located between the two ends	Off

Valid connections and required GDTSETUP settings for the Narrow/Ultra SCSI Channel (Remark: The ICP firmware always assigns the Narrow/Ultra SCSI Channel as the last channel number, i.e., Channel F).

50 pin Connector	Termination
Not occupied	On
Occupied and end terminated	On
Occupied and both ends terminated, i.e., channel connector is located between the two ends	Off

B.4.3 SCSI ID

All participants on the SCSI bus must have a unique identification number, that is, each number can only be used once on a given cable. Each SCSI device is uniquely addressed through its SCSI ID.

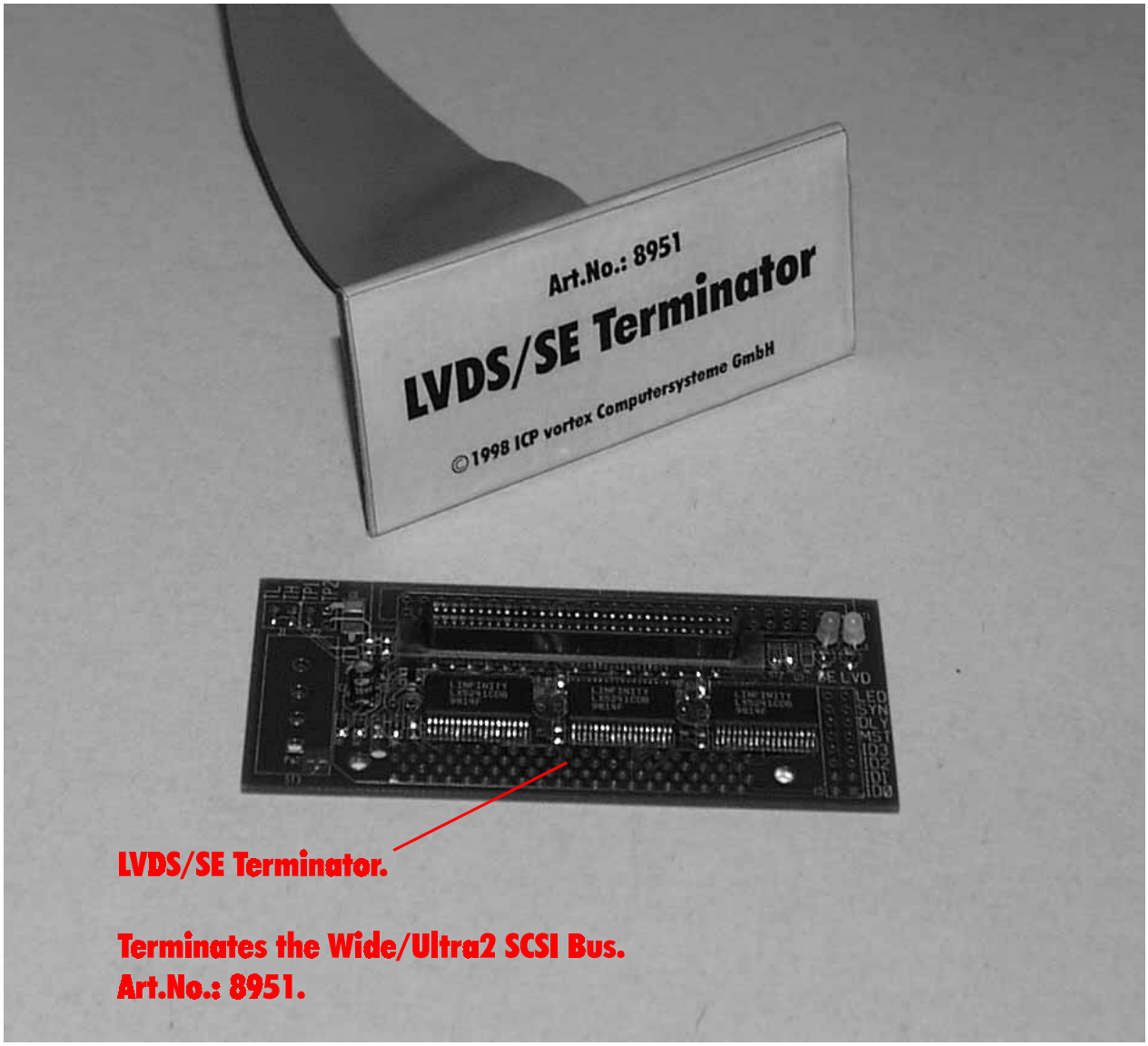
- All participants of a SCSI bus must have a different SCSI ID.
- The factory set SCSI ID of the ICP Controller SCSI channel is 7.
- Up to 15 SCSI devices can be connected to the Wide/Ultra2 SCSI channels
- Up to 7 SCSI devices can be connected to the Narrow/Ultra SCSI channel

On hard disks, CD-ROMs, tape streamers, etc., the SCSI ID is normally set through jumpers or small GDT switches. The ICP Controllers offer a far more comfortable method: software switches in the GDTSETUP program allow you to easily set the SCSI ID of a GDT SCSI channel. It is recommended to leave the default ID value at 7 (allowed values 0, 1, 2, 3, 4, 5, 6 and 7). Some operating systems require that the SCSI ID of certain SCSI device (e.g., tape streamer, CD-ROM) is set to a particular value (for more information, please refer to the appropriate chapter in this manual).

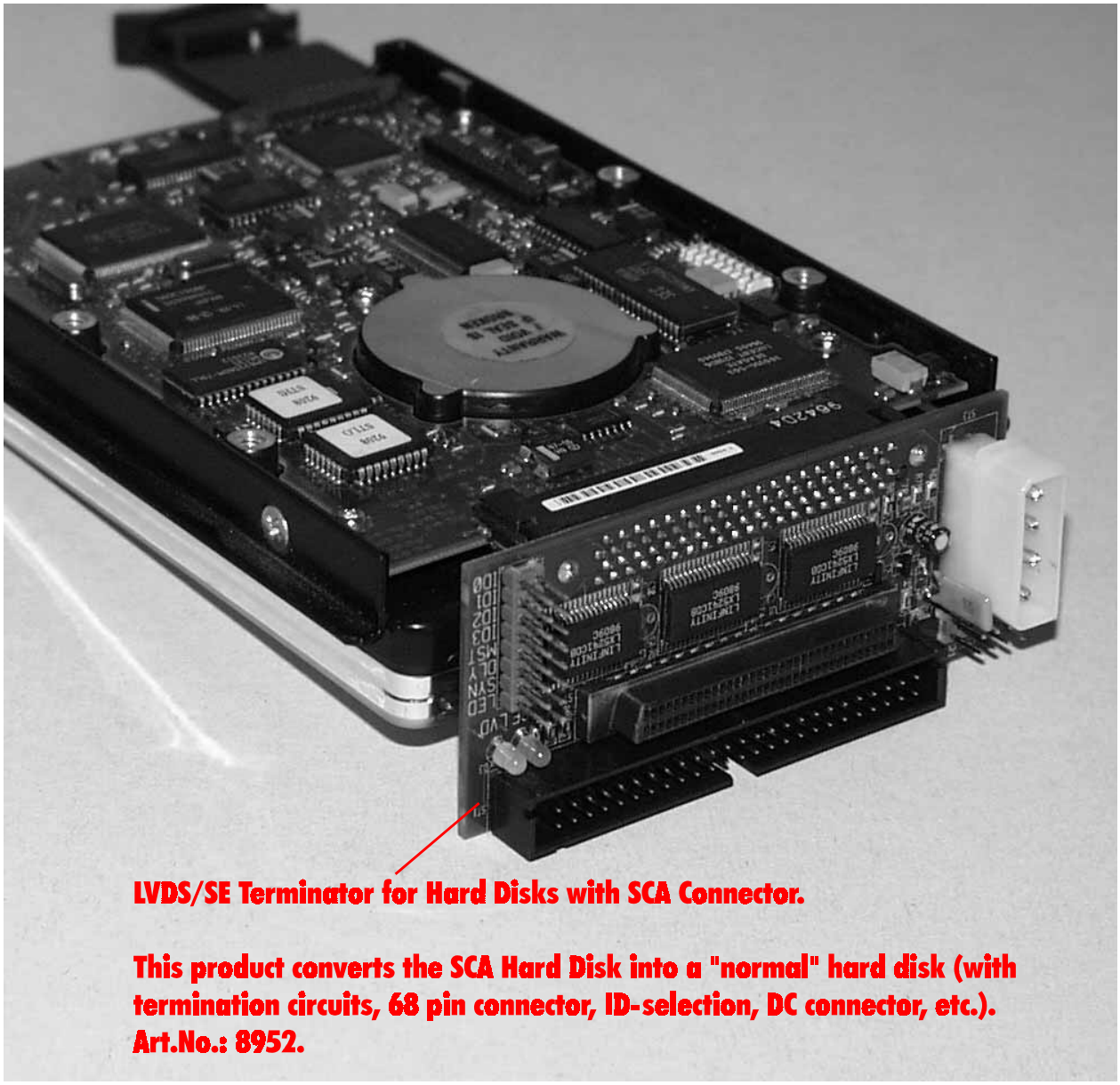
B.4.4 ICP SCSI Accessories

Order #	Part Name	Description	Application
8840	Fast-SCSI Bracket	External SCSI connector with an internal 50 pin header and an external 50 pin HD SCSI connector (female).	Connection of an external Narrow/Ultra SCSI subsystem with an internal Narrow/Ultra channel. **Not for LVDS operation.**
8841	Wide-SCSI Adapter	16 Bit to 8 Bit SCSI adapter with a 50 pin header and a 68 pin HD SCSI connector (male).	Connection of Wide/Ultra SCSI devices with an 8 Bit 50 pin flat ribbon cable. **Not for LVDS operation.**
8842	Wide-SCSI Bracket	External SCSI connector with an internal and an external 68 pin HD SCSI connector (female).	Connection of an external Wide/Ultra SCSI subsystem with an internal Wide/Ultra channel. **Not for LVDS operation.**
8843	Wide/Ultra Flat Ribbon Cable	80 cm Wide/Ultra SCSI cable with four 68 pin HD SCSI connectors (male).	Connection of up to 3 internal Wide/Ultra SCSI devices per SCSI channel.
8846	Narrow-Wide Bracket	External SCSI connector with an internal 68 pin connector (female) and an external 50 pin HD SCSI connector (female).	Connection of an external Narrow/Ultra SCSI subsystem with an internal Wide/Ultra channel. **Not for LVDS operation.**
8951	LVDS/SE Terminator	Terminator for LVDS or SE buses with 68 pin HD SCSI connector (female). LEDs indicate, whether the bus/terminator is operating in SE or LVDS mode.	Termination of SE or LVDS 68 pin cables.
8952	LVDS/SE Terminator for SE/LVDS Hard Disks with SCA Connector.	Terminator for LVDS or SE buses with SCA connector for the hard disk and 68 pin HD SCSI connector (female). Connector for DC. Jumpers for SCSI-ID, Termination, Termpower, etc.	This product converts Wide/Ultra2 or Wide/Ultra hard disks with SCA connector into "normal" hard disks with termination (SE and LVDS), DC connector, Jumpers for SCSI-ID, etc..

LVDS/SE Terminator for 68 pin SE or LVDS cable.



LVDS/SE Terminator for SE/LVDS Hard Disks with SCA Connector.



LVDS/SE Terminator for Hard Disks with SCA Connector.

This product converts the SCA Hard Disk into a "normal" hard disk (with termination circuits, 68 pin connector, ID-selection, DC connector, etc.). Art.No.: 8952.

B.4.5 Examples

On the following pages, are some examples of correct SCSI cabling.

First of all a few general tips:

- The ICP firmware always assigns the Narrow/Ultra SCSI Channel as the last channel number. I.e.,

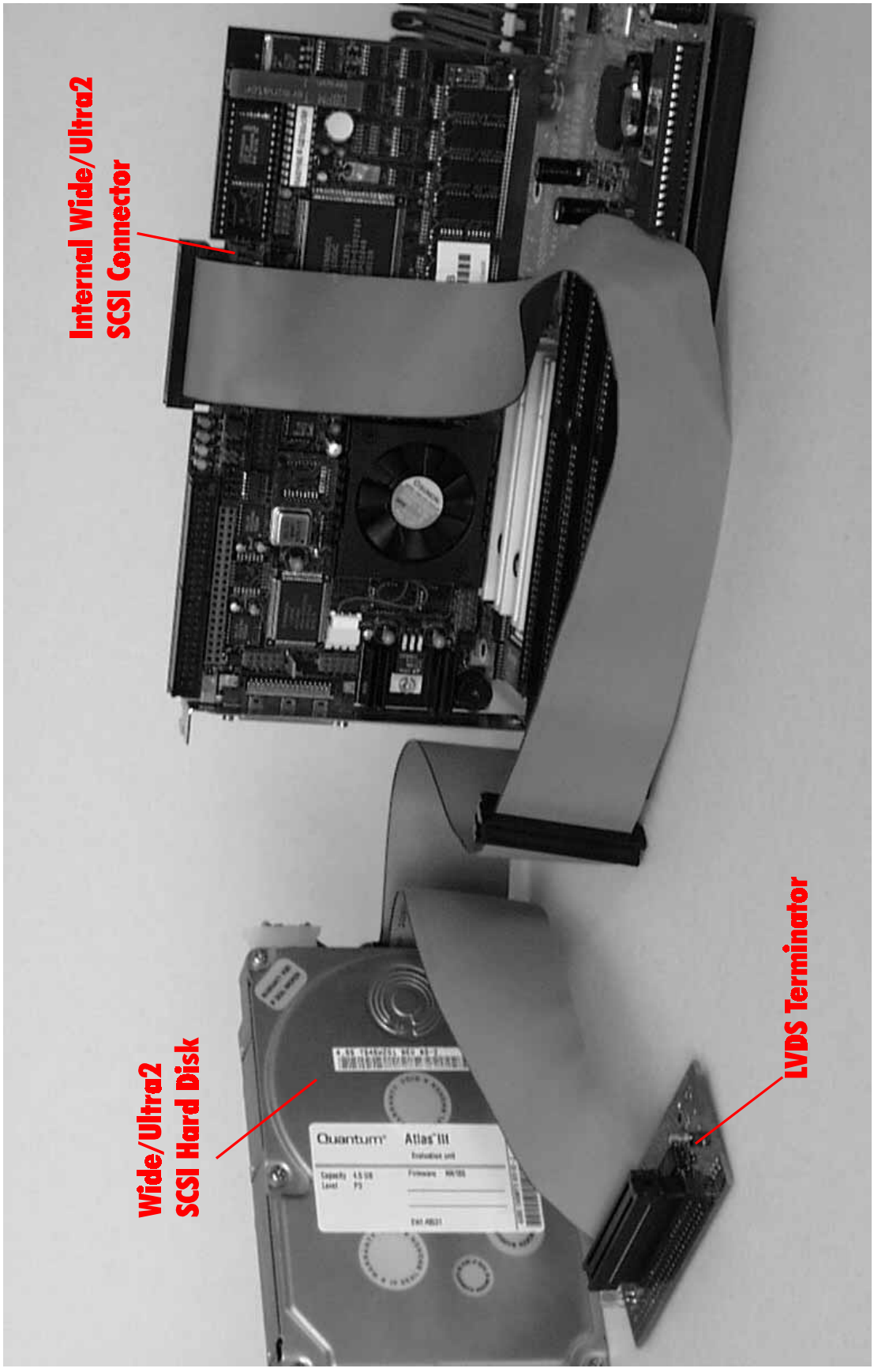
ICP Controller	Wide/Ultra2 SCSI Channels	Narrow/Ultra SCSI Channel
GDT6118RD GDT6518RD	A	B
GDT6128RD GDT6528RD	A, B	C
GDT6538RD	A, B, C	D
GDT6558RD	A, B, C, D, E	F

- SE-devices (e.g., Ultra SCSI hard disks, CD-ROM drives, DAT drives, Scanners, Printers, DLT drives, etc.) should always be connected with the Narrow/Ultra SCSI channel of the ICP Controller. This SCSI channel, which is completely independent of the Wide/Ultra2 SCSI channels, was specifically integrated onto the ICP Controllers for these kinds of SE-devices. Whoever is familiar with the ICP Controllers of the RP Series knows that this separate Narrow/Ultra SCSI channel is as valuable as a GDT6111RP controller.

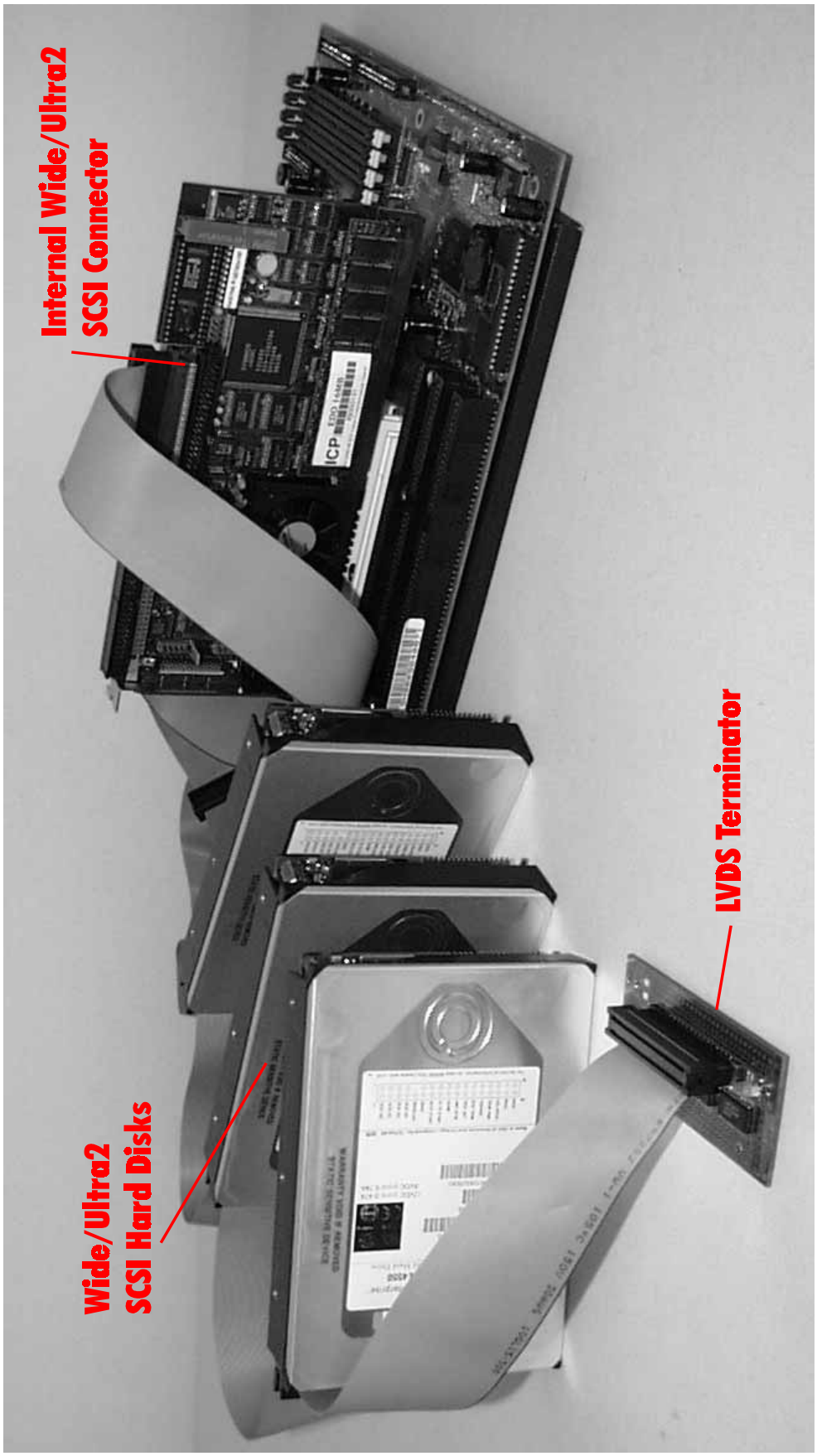
- If it cannot be avoided that SE-devices and LVDS-devices are connected with a Wide/Ultra2 SCSI channel, you have to be aware of the fact that the whole bus will then operate in SE-mode (cable length 1.5 meters). Imagine the following scenario: A SCSI bus system was initially set up with a 10-meter cable and 6 Wide/Ultra2 hard disk drives. As soon as you connect an SE-device (e.g., an Ultra SCSI hard disk) with this channel, the SCSI-Mode is automatically switched to SE. Therefore, the maximum cable length is reduced to 1.5 meters and therefore the whole setup will not work any longer.

- All ICP Controllers of the RD Series have a yellow LED for each Wide/Ultra2 SCSI channel. This LED indicates the current SCSI-Mode of the corresponding channel. If the LED is lit, the Wide/Ultra2 SCSI channel is operating in LVDS-Mode.
  If the LED is not lit, this channel is operating in SE-Mode only.
  (The same applies to the SCSI accessories Art.No.: 8951 and 8952. There are two LEDs indicating the current SCSI-Mode: Green=SE, Yellow=LVDS).

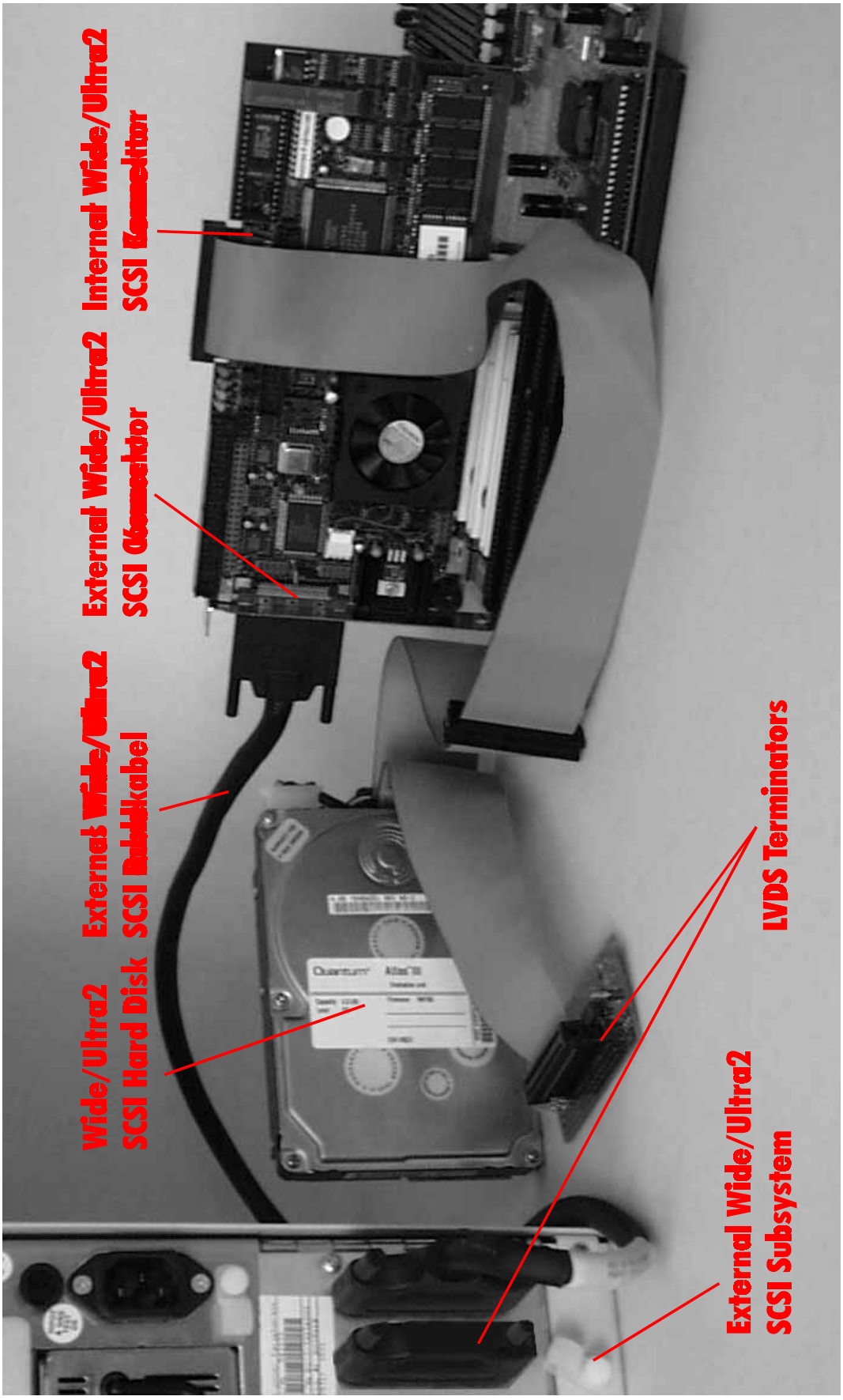
One internal Wide/Ultra2 SCSI Hard Disk



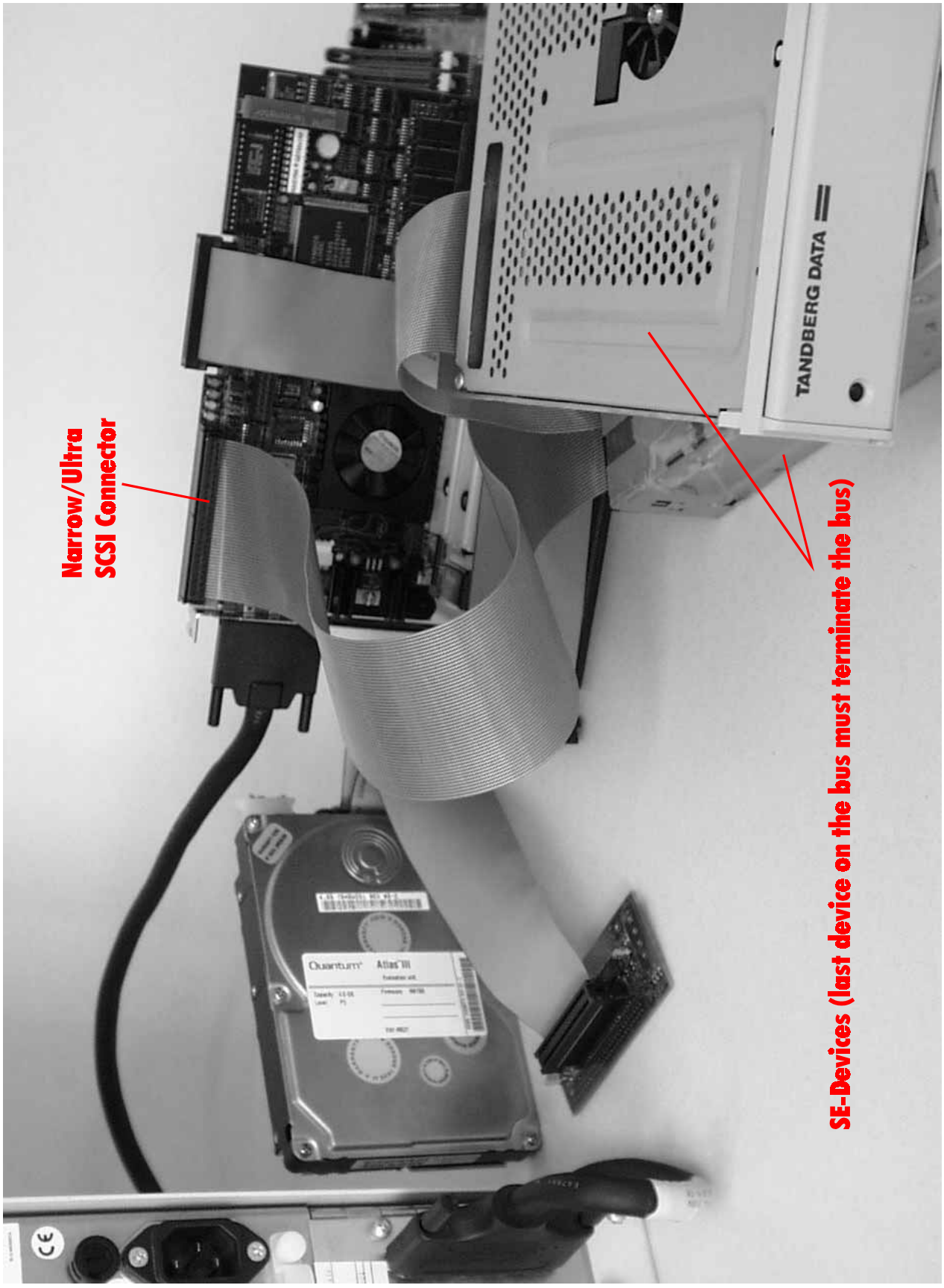
Several internal Wide/Ultra2 SCSI Hard Disks



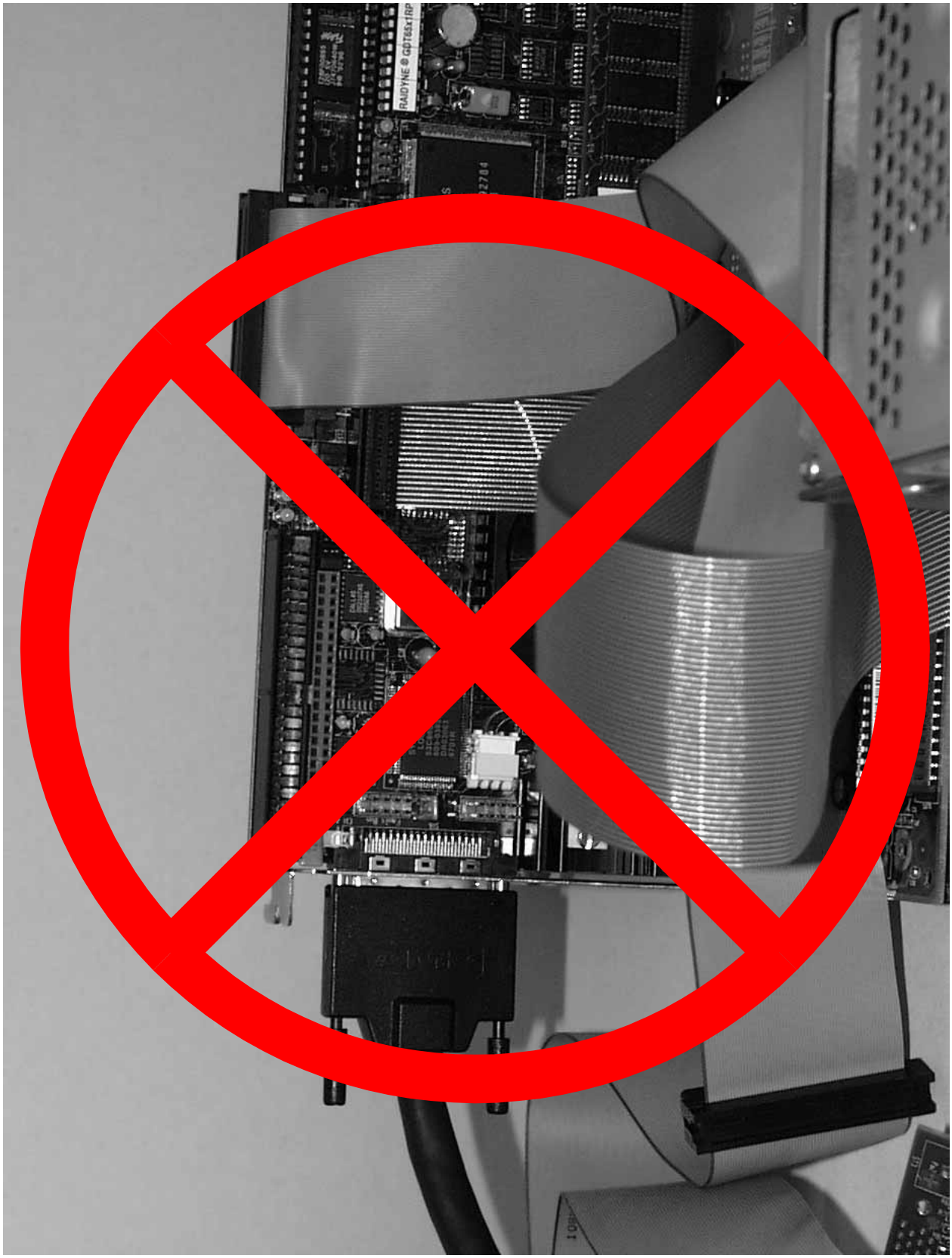
Internal and external Wide/Ultra2 SCSI Hard Disks



Internal and external Wide/Ultra2 SCSI Hard Disks and SE-Devices



Invalid Configuration



B.5 Installing the ICP Controller

Make sure that the ICP Controller is equipped with an appropriate SIMM. As already mentioned it is ***not*** possible to operate the ICP Controller without a SIMM.

Step 1
Switch off the PCI computer system and remove all cables (first of all the power supply).

Step 2
Following the instructions in the computer manual, open the case of the PCI computer, so that you have easy access to the PCI expansion slots.

Step 3
Select a free **PCI bus-master slot** and remove the metal bracket, following the instructions in your PCI computer manual. It is essential that the ICP Controller is plugged into a bus-master slot (it will NOT work in a slave or non-bus-master slot). Some motherboards have only 1 bus-master slot.
Make sure that the selected slot has a sufficiently cooling airflow. Permanent overheating of electronic devices decreases their life time drastically.

Step 4
Push the ICP Controller firmly into the correct PCI bus-master slot. Make sure that the controller fits tightly into it, and that the external SCSI connector sticks out of the computer case. Now, fix the ICP Controller by tightening the screw of its bracket.

Step 5
To connect internal SCSI devices, use the internal SCSI connectors of the ICP Controller. You need 50-pin or 68-pin SCSI flat ribbon cables with appropriate connectors. Please verify that the colored core of the SCSI flat ribbon cable connects PIN1 of the GDT SCSI connector to PIN1 of the SCSI device. To connect an external SCSI device, an external round cable is needed. Please make sure that the total length does not exceed the limits which are determined by mode and transfer rate. Regardless of whether the SCSI devices are connected to the internal or the external SCSI connectors of the ICP Controller, you should only use **cables of highest quality** in order to ensure an interference-free data transfer. Double-check that no other SCSI device has its SCSI-ID set to 7, as this is the **SCSI-ID** of the ICP Controller **(= SCSI IDentification number, assuming values between 0 and 7).** If necessary, the ID of the SCSI channels can be changed with the GDTSETUP program (see later in this chapter). The SCSI-ID can be chosen directly on the SCSI device by setting DIP switches or jumpers (please refer to the manual of the SCSI device). Furthermore, all SCSI devices connected to a given SCSI channel must have **different SCSI-IDs**. Additionally, it is important that the **SCSI terminators** are removed or switched off when more than one SCSI device is operated together with the ICP Controller. Only the last and the first participant of a SCSI channel (i.e., the two ends) may have SCSI terminators whereas all other participants on the SCSI bus must have their terminators removed or - if possible - switched off. The TERMPOWER jumpers) on the ICP Controller are usually set. This setting may only be modified if the terminator power on the SCSI cable is supplied by another SCSI device. The terminator power line on the SCSI cable may be used by SCSI devices which do not supply DC power to their own SCSI termination circuitry (e.g., external SCSI terminator packs.).

Step 6
When installing internal SCSI devices, make sure that the slots of the SCSI devices have sufficient air flow, and that the power consumption of all SCSI devices does not exceed the capacity of the computer's power supply. An overloaded DC power supply has a poor DC voltage quality (*noise*, *ripple*) and causes problems for all connected consuming devices.

Step 7
If required, you can connect the HDD-front-LEDs of the PCI computer system to the LED connectors of the ICP Controller.

Step 8
Before the PCI computer system is switched on, you should check the following points over again:

- Is the SIMM plugged firmly into the SIMM socket ?
- Is the ICP Controller plugged firmly into one of the PCI bus-master slots ?
- Are the SCSI-IDs set correctly ?
  (with no other device currently set to ID 7 ?)
- Are the SCSI-bus terminators plugged/set correctly ?
  (with currently terminated GDT SCSI channels ?)
- Are the SCSI flat ribbon cables connected correctly ?
- Are all SCSI devices installed properly and connected to the power supply of the PCI computer system ?

Step 9
After having checked all the points in "Step 8", reconnect the PCI computer system to the power supply. Do not close the computer case yet.

B.7 ICP Controller Function Check

Before we put the ICP Controller into operation for the first time, we would like to spend a few words on the PCI 2.x compatibility requirements a PCI computer system (especially the motherboard and the motherboard's BIOS) should meet.

B.7.1 PCI 2.x Compatibility Requirements

A **pre-condition** for a flawless installation of PCI bus-master expansion cards (the ICP Controllers belong to this group of expansion cards) in a PCI motherboard is **a 100% PCI 2.x compatible System-BIOS**.

We have observed more than once that a motherboard declared fully PCI 2.x compatible was equipped with a System-BIOS (located in an EPROM or FLASH-RAM) which was not PCI 2.x compatible at all. To make up for this, many manufacturers of PCI motherboards or PCI computer systems offer their customers a Website (and/or a BBS) from where the latest PCI-system-BIOS version can be downloaded.
As PCI is a rapidly growing market and more and more bus-master expansion cards (high performance disk and LAN controllers) are becoming available, we have no doubt that such problems will be resolved very quickly by the respective system-BIOS manufacturer.

The System is fully PCI compatible.
If your PCI motherboard/computer is 100% PCI compatible, its PCI system-BIOS will, to a large extent automatically (*plug & play*), carry out the configuration (e.g., mapping of the ICP Controller's BIOS and DPMEM, assignment of a proper system IRQ to a PCI interrupt). This means that the PCI computer system (with its motherboard and PCI system-BIOS) must meet the following requirements:

1. The PCI computer system must automatically assign (map) the ICP Controller BIOS to an adequate address in the lower, 1MB area of the computer system's main memory.

2. The PCI computer system must map the ICP Controller's Dual Ported Memory (needed for high performance operation) to an adequate address in the lower, 1MB area of the computer system's main memory. In addition, it has to disable the shadowing of this address <SPACE>.

3. Assigning a system IRQ to a PCI interrupt.
   The PCI 2.x specification prescribes 4 PCI interrupts, called INT A, INT B, INT C and INT D. A PCI interrupt must be assigned to a free (unused) IRQ of the PCI motherboard or computer. The ICP Controller is shipped with PCI INT A.

   Depending on the manufacturer of the PCI computer system, there are several ways to carry out this task:

   - automatically (automatic IRQ routing)
   - with the PCI System-BIOS setup program
   - with the PCI System-BIOS setup program *and* jumper settings on the system motherboard

   Depending on the BIOS manufacturer (e.g., Award, Phoenix, etc.), the setup program is activated by pressing a certain key-combination shortly after the reset (cold boot or warm boot). For detailed information on the key-combination and the jumpers' locations and settings, please refer to the system manual of your PCI motherboard or computer.

The System is not fully PCI compatible.
Problems may occur if the motherboard and/or System-BIOS are not fully PCI 2.x compatible. The best remedy is to update the PCI system-BIOS to the latest version.
Furthermore, we have integrated into our GDT BIOS various routines (*tricks*) which remedy the incompatibilities of some PCI system-BIOSes, at least with regard to the ICP Controller.

B.7.2 Switching On the PCI Computer System

Now, after having installed the ICP Controller and the SCSI devices, check whether the controller is working correctly. If the ICP Controller is the only controller in the computer system, set hard disks C: and D: to ***not available*** in the System-BIOS setup program of the computer. Normally, you can start the BIOS setup program by pressing a certain key-combination after switching on the computer. After switching on the PCI computer system, pay attention to the LEDs of the ICP Controller.

- If everything is installed correctly, the green LED "S" will light up when switching on the PCI computer system. The green LED "S" (S for status) shows that the ICP Controller is online. If this green LED does not react as described above, switch off the PCI computer and double-check the correct installation of the ICP Controller.

- The electronic loudspeaker of the ICP Controller gives forth a series of 4 signals with a pause between the first two).

- The other green LED "T" may flicker sometimes (it always lights up during BUS-Master DMA transfers; the brighter it lights, the more DMAs).

- The yellow LEDs indicate accesses to the SCSI devices. They also may flicker occasionally as GDT scans the SCSI channels for existing SCSI devices. The yellow LED "SCSI" flickers whenever a SCSI device on any of the ICP Controller's SCSI channels is accessed.

The GDT boot message appears. In the following example, a GDT6518RD Controller has been detected in PCI slot 3, and it has 16MB of RAM ("16 MB RAM detected.."). On the Wide/Ultra2 SCSI channel three Ultra2 Quantum hard disks have been recognized, and, on the Narrow/Ultra SCSI channel B, a DLT2000XT streamer and a NEC CDROM drive.

```
GDT - PCI        Disk Array Controller BIOS                    Version 2.55a
Copyright (C) 1991-98 by ICP vortex Computersysteme GmbH         Mar 3 1998
All rights reserved!
BIOS located at 0x000E0000 - 0x000E1FFF
1 Controller(s) found, Selftests OK, scanning I/O channels ...
[PCI 0/3] DPMEM at 0x000D0000 - 0x000D3FFF  INTA = IRQ10
[PCI 0/3] GDT6518RD -- HWL0 -- 16 MB RAM -- 1024kB/0kB Flash-RAM
[PCI 0/3] Serial-No. 00123412 -- RAIDYNE-FW-Version 2.22.00-RFFF -- May 17 1998
[PCI 0/3] SCSI-A ID:0 LUN:0 -- QUANTUM  QM34500T
[PCI 0/3] SCSI-A ID:1 LUN:0 -- QUANTUM  QM34500T
[PCI 0/3] SCSI-A ID:2 LUN:0 -- QUANTUM  QM34500T
[PCI 0/3] SCSI-B ID:1 LUN:0 -- DLT2000XT
[PCI 0/3] SCSI-B ID:2 LUN:0 --NEC CDR
[PCI 0/3] RAID-5 Host Drive 1 installed (ready)

<<< Press <CTRL><G> to enter GDTSETUP >>>
```

The single messages have the following meaning:

BIOS located at 0x000E0000 - 0x000E1FFF
Unlike ISA or EISA computers where the BIOS address of a peripheral expansion card is set manually (ISA, jumpers) or with the help of a configuration file (EISA, cfg file) and the address space is determined by the user, the PCI system-BIOS automatically maps the BIOS of a PCI compatible peripheral expansion card to a memory address. At each cold or warm boot, it determines which address space to assign to the BIOS of an expansion card. The message shown above reports the physical address occupied by the GDT BIOS.

[PCI 0/3]
PCI device, bus system ***0***, slot ***3***. The PCI 2.x specification allows several PCI bus systems to be present in one PCI computer. All ICP Controllers have been designed to support multiple PCI bus system computers. The slot number indicated in the message above does not refer to the 3rd PCI slot, but indicates that the ICP Controller is plugged into a slot which is the third one the PCI chipset of the PCI computer can access. To determine which physical PCI slot this corresponds to, consult the system manual of your PCI computer.

DPMEM at 0x000D0000 - 0x000D3FFF INTA = IRQ10
DPMEM stands for ***D***ual ***P***orted ***MEM***ory. The ICP Controller needs this 16KB address space of the PCI Computer for the command communication. In our example, the address space begins at D000:0000 and ends at D000:3FFF (D000 is the segment address). As with the ICP Controller BIOS, this mapping, is also automatically carried out by the PCI system-BIOS. This information is essential when installing Expanded Memory Managers under DOS and Windows. The GDT DPMEM address space has to be excluded from the control of such a manager. (For more details, see chapter C of this manual). Furthermore, this messages tells us that the PCI ***INT A*** of the ICP Controller has been assigned to the system ***IRQ10***. This assignment, is also carried out automatically if the PCI system-BIOS is 100% PCI 2.X compatible.

GDT6518RD -- HWL0 -- 16 MB RAM - 1024kB/0kB Flash-RAM
GDT6518RD -- HWL0 stands for the type of ICP Controller found by the GDT BIOS. HWL means Hardware level. ***16 MB RAM*** indicates that the installed SIMM is a 16MB, non-parity Fast Page Mode (FPM) SIMM. Depending on the type and size of the installed SIMM the following messages are possible (xx = 4, 8, 16, 32, 64, 128):

xx MB RAM	xx MB Fast Page Mode (FPM) SIMM without parity (i.e. 32 bit)
xx MB RAM/P	xx MB Fast Page Mode (FPM) SIMM with parity (i.e. 36 bit)
xx MB EDO-RAM	xx MB Extended Data Out (EDO) SIMM without parity (i.e. 32 bit)
xx MB EDO-RAM/P	xx MB Extended Data Out (EDO) SIMM with parity (i.e. 36 bit)

When a parity SIMM is installed this message is followed by: ***ECC/Parity support enabled***.
1024kB/0kB Flash-RAM indicates the size of the installed Flash-RAM. "1024kB" refers to the onboard Flash-RAM size. The "/0kB" stands for an empty Flash-RAM expansion socket (Feature Socket).

SCSI-A indicates the SCSI devices connected with the controller's Wide/Ultra2 SCSI channel. The last SCSI channel (in our example SCSI-B indicates the SCSI device connected with the controller's Narrow/Ultra SCSI channel. With a GDT6558RD this would be SCSI-F).

<<< Press <CTRL><G> to enter GDTSETUP >>>
After pressing this hot-key, the message ***Entering GDTSETUP. Please wait...*** appears. The SCSI bus scan is completed and the built-in GDTSETUP configuration program is loaded. It allows you to configure RAID Array Drives.

B.7.3 Trouble Shooting

If these messages do not appear on the screen, or if other problems occur after switching on the computer system (screen remains dark etc.), you should check the entire installation over again:

- Are you using the correct SIM-module ? (Minimum 8MB, 60ns or faster for FPM and 50ns for EDO) *Try another one.*
- SIMM plugged firmly into the socket ? *Unplug it and plug it in again.*
- Is the ICP Controller plugged into a PCI bus-master Slot ? *Check this. If necessary, try another slot.*
- Is the SCSI cable OK ? *Check the length and connectors, Try another cable..*

If the **PCI System-BIOS is not PCI 2.x compatible** (see above), the ICP Controller BIOS may display one or more of the following messages:

(i) The DPMEM has not been installed correctly.

Error: ***System-BIOS not PCI compliant (contact your mainboard supplier)***
Controller at x/y has invalid DPMEM address 012345.
Trying to allocate a free address.
Found free address at 678901, accept ? (Yes/No/Abort) Y
(Caution: this address must not be used by another expansion card !)

In this case, the system-BIOS has not installed the Dual Ported Memory of the ICP Controller correctly. Therefore, the ICP Controller will search for an adequate address. If you accept the suggested address (***Y***), the ICP Controller will install its DPMEM starting at this address. Since this 16KB address space which starts at ***free address*** must not be shadowed,

you might have to disable the shadowing manually in the system-BIOS setup program. In addition, make sure that this address space is not used by another expansion card. (This is a work-around, not a solution. PCI 2.x is a well defined specification, and a fully compatible system-BIOS should have assigned the DPMEM automatically.)
If the GDT BIOS could not find an appropriate address, the following message is displayed:

Cannot set DPMEM address, aborting

In this event, you can try to select a new address after resetting the computer. If this fails, too, there is no other way but to update the PCI system-BIOS.

(ii) The IRQ to PCI INT assignment doesn't work properly.

Warning: controller at x/y, System BIOS configured IRQ Z, but uses U

This warning indicates a bug in the PCI System-BIOS, too: It did not succeed in correctly assigning an IRQ to a PCI INT. The ICP Controller will function, but the GDT BIOS must not be disabled whatsoever.

(iii) The IRQ to PCI INT assignment doesn't work at all.

Error: controller at x/y could not read IRQ setting

If this error message is displayed, the ICP Controller will not work.

In all these cases you should - in case (iii) you have to - update your PCI system-BIOS as soon as possible.

B.8 Checking the ICP Controller Configuration

As mentioned before, these settings can be changed through soft-switches in the ICP Controller setup program GDTSETUP. All settings are permanently stored on the ICP Controller. The following table shows the various options and the possible settings.

Function	*Possible Settings*	*Factory Setting*
Cache On (*)	On, Off	On
Delayed Write On (*)	On, Off	On
BIOS	Enabled, Disabled, Removed (**)	Enabled
BIOS Warning Level	All messages, Fatal errors	Fatal errors
Supported BIOS Drives	2,7	7
Memory Test	No Test, Standard, Double Scan, Intensive	Standard
SCSI-ID SCSI channels	0,1,2,3,4,5,6,7	7
SCSI Termination	On, Off, Auto	Auto

(*) Can also be changed with the GDTMON online utility. (**) Only with GDTSETUP under MS-DOS.

B.8.1 Loading GDTSETUP

As already mentioned before, there are two different possibilities to load GDTSETUP. Basically, these two possibilities are based on two different variants of the same program: One which is integrated into the FLASH-RAM of the ICP Controller and another with is simply an EXE program loadable under MS-DOS.
Loading GDTSETUP from the FLASH-RAM is very comfortable, since it requires nothing else, but pressing the <CTRL><G> key combination after switching on the PC.

Loading GDTSETUP under MS-DOS becomes necessary, when you want to use GDTSETUP's integrated partitioning functions, or when you have totally disabled the GDT's BIOS (which includes the GDTSETUP variant loadable from FLASH-RAM).

If you want to load GDTSETUP under MS-DOS you have to load the device driver GDTX000 first. This can be done in two ways:

1. Starting the device driver from the DOS-command level by typing GDTX000<ENTER>

2. Starting the device driver automatically by means of the CONFIG.SYS (DEVICE=GDTX000.EXE)

Note: GDTSETUP as well as GDTX000 are on the *System Disk* - DOS.
The header of the GDTSETUP program indicates with a letter after the version number, whether GDTSETUP was loaded from disk or from Flash-RAM:

"**R**" for GDTSETUP loaded from the Flash-RAM after switching on the computer
"**D**" for GDTSETUP loaded from Disk, i.e., under MS-DOS.

The main menu appears. *Select Controller*.

GDTSETUP -- Version 3.03D - Mar 11 1998
(C) Copyright 1997-98 ICP vortex Computersysteme GmbH
Select Controller
No. Name Position Features Firmware
0 GDT6519RD [PCI 0/13] C M R 2.21.00-RFfF
F10: Toggle Colors
Features: C:Chaining, S:RAID-0, M:RAID-1, R:RAID-4/5/10

Select the ICP Controller and press <ENTER>.

GDTSETUP -- Version 3.03D - Mar 11 1998
(C) Copyright 1997-98 ICP vortex Computersysteme GmbH
Express Setup
Configure Host Drives
F2: Advanced Setup
[PCI 0/13]: GDT6519RD, RAM: 16 MB EDO, FW: 2.21.00-RFFF

Press the <F2>-key for the Advanced Setup.

GDTSETUP -- Version 3.03D - Mar 11 1998
(C) Copyright 1997-98 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Configure Array Drives
Configure Host Drives
Save Information
F2: Express Setup
[PCI 0/13]: GDT6519RD, RAM: 16 MB EDO, FW: 2.21.00-RFFF

Select *Configure Controller* and press <ENTER>.

The fields can be selected by moving the cursor keys ↑ and ↓ . The values can be changed by pressing <ENTER> and selecting a new setting. Leave this menu by pressing the <ESC>-key. In order obtain optimum performance from your ICP Controller, it is essential that the *Cache* and the *Delayed Write* options of the ICP Controller are set ***ON***, too. If you should find different settings here, we recommend that they be changed now.

B.8.2 Updating the ICP Controller With New Firmware and BIOS Versions

The firmware, the BIOS and the GDTSETUP program of the ICP Controller are stored in a Flash-RAM which is part of the ICP Controller hardware. In contrast to EPROMs, Flash-RAMs can be re-programmed many times and without the complicated UV-light erasing procedure. Thus, both software modules can be easily updated without having to remove the controller from its PCI slot. Firmware and BIOS are part of the ***GDT_RPFW*** file. The file has an extension (e.g., GDT_RPFW.009) which indicates the version stepping. The latest version of the this file can be downloaded either from our 24h BBS (+49-(0)-7131-5972-15) or from our Website http://www.icp-vortex.com. We recommend that you also download the packed files which contain the latest programs/drivers for the operating system used on your system. Observe the following order when carrying out the updating procedure:

1. Get the latest GDT_RPFW file for the ICP Controller (download it from our BBS, or our Website, or ask for an upgrade disk if you do not have a modem). The file does NOT need to be expanded !

2. Format a 3.5" HD disk (1.44MB) and copy the GDT_RPFW file on this disk.

3. After loading GDTSETUP (from Flash-RAM or from disk under MS-DOS) select the desired ICP Controller for the firmware update and press the <F2>-key to enter the Advanced Setup.

4. Select *Configure Controller* and thereafter *Firmware Update*. Insert the disk with the firmware file into drive A. GDTSETUP loaded from the Flash-RAM will display a list of the valid files found on the disk. If you have loaded GDTSETUP from disk you have to enter the path "A:", first.

GDTSETUP -- Version 3.03D - Mar 11 1998
(C) Copyright 1997-98 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Co Configure Controller
Co Controller Settings
Co Firmware Update
Co Intelligent Fault Bus
Path: A:
[PCI 0/13]: GDT6519RD, RAM: 16 MB EDO, FW: 2.21.00-RFFF

5. The update process starts as soon as the desired GDT_RPFW file has been selected. Strictly observe the messages and instructions of GDTSETUP. It is extremely important that the system is not switched off or reset during the update process. It is very likely that this would cause the ICP Controller to become inoperable.

The new versions of the GDT Firmware, the BIOS and GDTSETUP are available after the next cold-boot.

B.8.3 Additional Notes

Before the computer is switched off or a hard reset is carried out, the* ICP Controller *first has to write the current contents of its cache* RAM *back to the hard disk(s) (flush). The computer may only be switched off or reset after all hard disk accesses have been completed. If this is not observed there is a high risk of data corruption and data loss ! A good indication for hard disk activity is the front HDD-LED of your computer system (presuming it is connected with the corresponding pin grid header of the GDT PCB). In addition, all GDT drivers (i.e. for all supported operating systems) are designed to perform a cache flush when a regular system shutdown is initiated (e.g., Under NetWare: *Down* and *Exit*; Under DOS: CTRL-ALT-DEL; Under UNIX: *Shutdown*). They will show a message similar to the following "*Flushing Controller Cache*". As long as this message is displayed you must not switch off or reset your PCI computer. For Windows 95, Windows NT and OS/2 you may switch off or reset the computer as soon as the operating system message is displayed, which indicates that it is safe, to turn off the computer now.

The RISC CPU of the ICP Controller is equipped with a cooler. The cooler keeps the operating temperature of the CPU within the specified limits. The air intake is on the top of the fan. The air flows through the fins of the heat sink and leaves it on the left and right side. In addition, it is necessary that the whole ICP Controller is positioned in a constant airflow. Normally, good server enclosures have extra fans for the motherboard expansion slot area. In case of over temperature, the ICP Controller sends a message to the operator.
The cooler on your* ICP Controller *may look different from the one on pages of this manual. Depending on the type of i960 Rx* CPU *installed on the* ICP Controller*, with some models, the cooler is completely missing. This is intended !
***All variants fully comply to the specifications laid down in this* User's Manual.**

Chapter C

Quick-Setup

Intelligent Computer Peripherals ®

ICP

C. Quick-Setup

C.1 What is the Aim of Quick-Setup ?

In the previous chapter we installed the ICP Controller in a PCI computer and connected the SCSI devices. Now these SCSI devices must be prepared in order to run with your operating system. This **Quick-Setup** chapter should help you to get started quickly. Quick-Setup shows **four examples** on how a single SCSI hard disk, a Mirroring Array Drive (RAID 1), a RAID 5 Array Drive and a RAID 5 Array Drive with a Hot Fix drive are installed:

Example 1: Installing a single SCSI hard disk.

Example 2: Installing a Mirroring Array Drive (RAID 1), consisting of two SCSI hard disks.

Example 3: Installing a RAID 5 Array Drive, consisting of five identical SCSI hard disks.

Example 4: Installing a RAID 5 Array Drive, consisting of four identical SCSI hard disks, and adding one Hot Fix SCSI hard disk.

Examples 3 and 4 are not applicable to ICP Controllers without the RAIDYNE firmware. Even if you cannot practically carry out all the examples yourself, we suggest reading them all the same because they will give you a better understanding of how the controllers of the GDT RP Series work. The following table tells you which examples are applicable to your type of ICP Controller.

	Example 1	Example 2	Example 3	Example 4
GDT6118RD	Yes	Yes	No(*)	No(*)
GDT6128RD	Yes	Yes	No(*)	No(*)
GDT6518RD	Yes	Yes	Yes	Yes
GDT6528RD	Yes	Yes	Yes	Yes
GDT6538RD	Yes	Yes	Yes	Yes
GDT6558RD	Yes	Yes	Yes	Yes

(*) **Yes**, when RAIDYNE U*pgrade* installed.

With examples 3 and 4 we shall briefly repeat the installation of the ICP Controller and the SCSI devices, in particular with regard to disk arrays.
Some essential issues having direct impact on the structure and configuration of an Array Drive with RAIDYNE will also be discussed:

1. How many physical SCSI hard disks are to be integrated in the Array Drive ?
2. Which redundancy level ought to be achieved ?
3. Should RAIDYNE automatically recover redundancy in the event of a disk failure ? Or, in other terms: Are Hot Fix drives needed ?

Before we go through these examples step by step, we would like to explain a few terms and relations important for the basic understanding of the ICP Controller firmware. At the end of example 4, we will try to answer the three questions above.

C.2 What is the ICP Controller Firmware ?

We refer to firmware as the operating system which controls the ICP Controller with all its functions and capabilities. The firmware exclusively runs on the ICP Controller and is stored in the Flash-RAM on the ICP Controller PCB. The controlling function is entirely independent of the PCI computer and the host operating system installed (for example UNIX), and does not "drain" any computing power or time from the PCI computer. According to the performance requirements needed, the ICP Controllers are available with two firmware variants. The firmware is either already installed on the controller upon delivery, or can be added as an upgrade: RAIDYNE *upgrade*.

- **Standard Firmware** (installed on the GDT6**1**x8RD controllers).
  In addition to simple controlling functions regarding SCSI hard disks or removable hard disks, this version allows disk chaining (several drives can be linked in order to form a single "large" drive), and the configuration of Array Drives of the types data striping (RAID 0) and disk mirroring or duplexing (RAID 1).

- **RAIDYNE Firmware** (installed on the GDT6**5**x8RD controllers). In addition to disk chaining, RAID 0 and RAID 1, RAIDYNE allows you to install and control Array Drives of the types RAID 4 (data striping with dedicated parity drive), RAID 5 (data striping with distributed parity) and RAID10 (a combination between RAID 0 and 1)

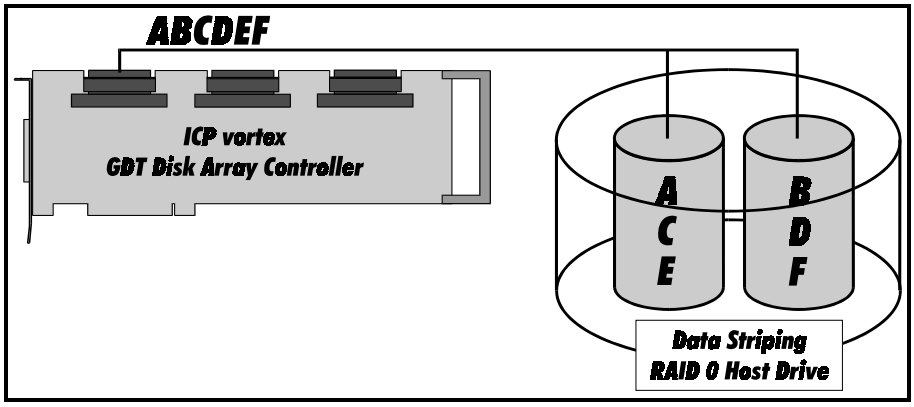
RAIDYNE is the name of the ICP disk-array operating system for the ICP Controllers. Unlike pure software solutions, RAIDYNE is totally independent of the host operating system, and can therefore be accessed under MS-DOS, Windows, OS/2, SCO-UNIX, Interactive UNIX, Novell NetWare, etc.. Special RAID drivers are not needed. The integration of a RAID Disk Array into the host operating system is carried out with the same drivers used for the integration of a single SCSI hard disk. All ICP Controllers are equipped with a hardware which is particularly well suited for disk arrays. RAIDYNE uses this hardware with extreme efficiency and therefore allows you to configure disk arrays that do not load the host computer (whereas all software-based RAID solutions more or less reduce the overall performance of the host computer.).

The basic concept of the RAIDYNE is strictly modular, and consequently, in its functioning it appears to the user as a unit construction system.

C.2.1 The Different RAID Levels

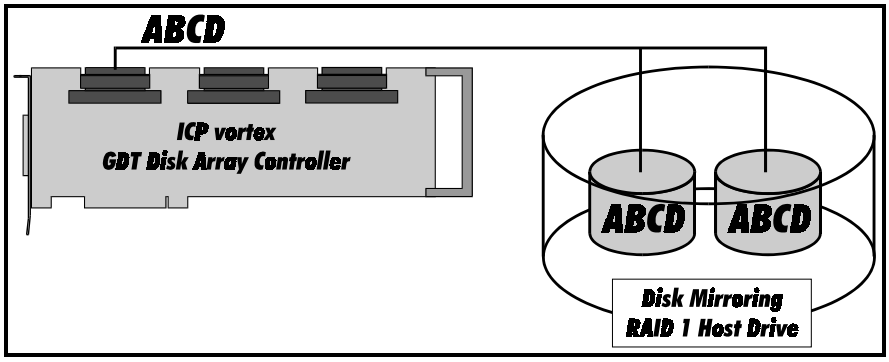
RAID 0 - Data Striping

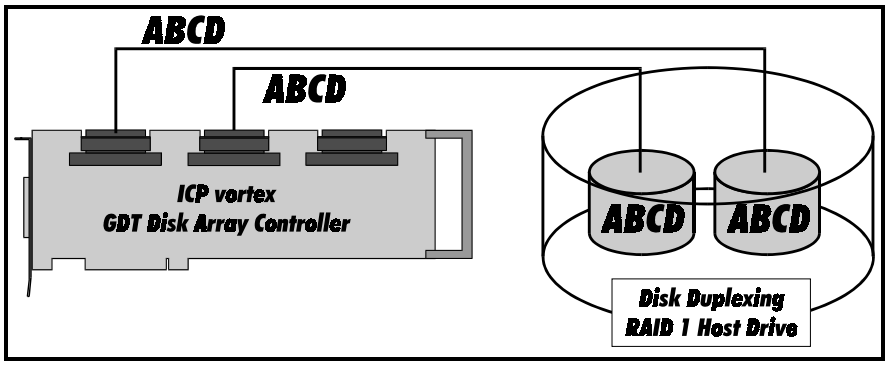
According to the adjusted stripe size (e.g., 16 KB) and the number of hard disks, the data blocks are split into stripes. Each stripe is stored on a separate hard disk. Especially with sequential read and write operations, we can observe a significant improvement of the data throughput. RAID 0 includes no redundancy at all, i.e., when one hard disk fails, all data is lost.



RAID 1 - Disk Mirroring/Disk Duplexing

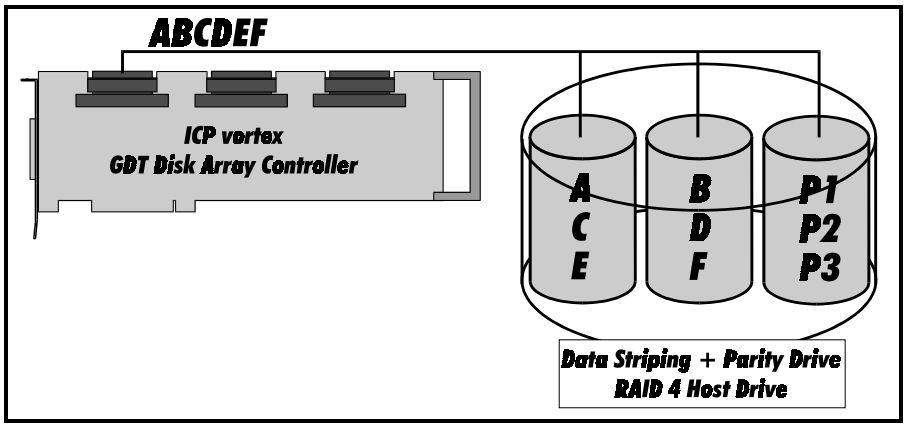
All data is stored twice on two identical hard disks. When one hard disk fails, all data are immediately available on the other without any impact on the performance and data integrity.
We talk about "Disk Mirroring" when two hard disks are mirrored on one SCSI channel. If each hard disk is connected with a separate SCSI channel, this is called "Disk Duplexing" (additional security).
RAID 1 represents an easy and highly efficient solution for data security and system availability. It is especially suitable for installations which are not too large (the capacity available is only half of the installed capacity).





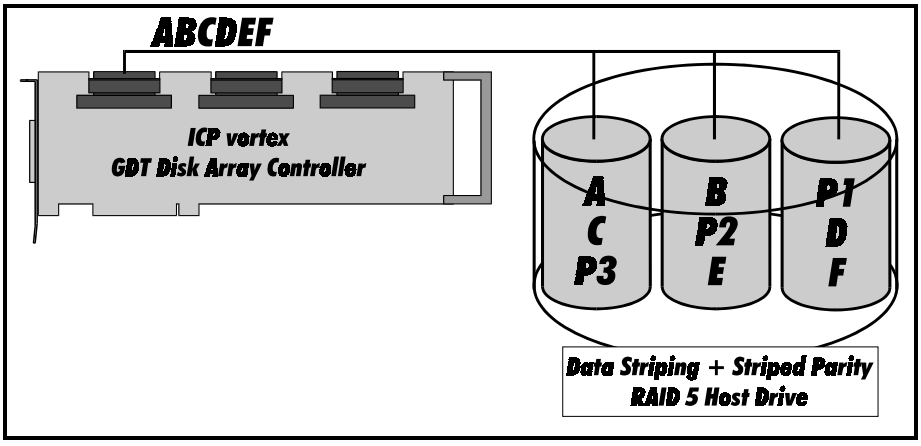
RAID 4 - Data Striping With a Dedicated Parity Drive

RAID 4 works in the same way as RAID 0. The data are striped amongst the hard disks. Additionally, the controller calculates redundancy data (parity information) which are stored on a separate hard disk (P1, P2, ...). Even when one hard disk fails, all data are still fully available. The missing data is recalculated from the data still available and the parity information. Unlike in RAID 1, only the capacity of one hard disk is needed for the redundancy. If we consider, for example, a RAID 4 disk array with 5 hard disks, 80% of the installed hard disk capacity is available as user capacity, only 20% is used for redundancy. In situations with many small data blocks, the parity hard disk becomes a throughput bottle-neck. With large data blocks, RAID 4 shows significantly improved performance.



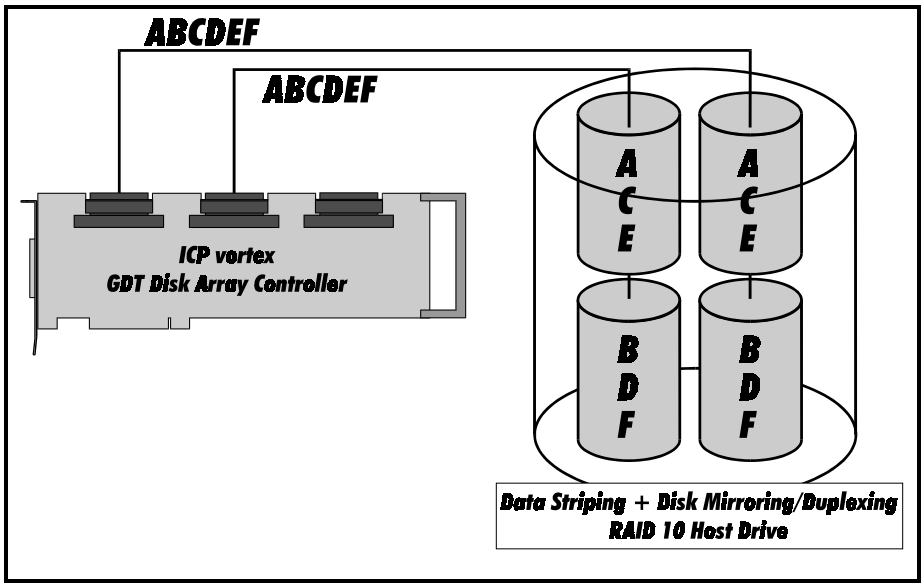
RAID 5 - Data Striping with Striped Parity

Unlike RAID 4, the parity data in a RAID 5 disk array are striped in all hard disks. The RAID 5 disk array delivers a balanced throughput. Even with small data blocks, which are very likely in a multi-tasking and multi-user environment, the response time is very good. RAID 5 offers the same level of security as RAID 4. When one hard disk fails, all data are still fully available, the missing data are recalculated from the data still available and the parity information. RAID 4 and RAID 5 are particularly suitable for systems with medium to large capacity requirements, due to their efficient ratio of the installed and actually available capacity.



RAID 10 - Combination of RAID 1 and RAID 0

The idea behind RAID 10 is simply based on the combination of RAID 0 (Performance) and RAID 1 (Data Security). Unlike RAID 4 and RAID 5, there is no need to calculate parity information. RAID 10 disk arrays offer good performance and data security. As in RAID 0, optimum performance is achieved in highly sequential load situations. Identical to RAID 1, 50% of the installed capacity is lost for redundancy.



C.3 How are the GDT Firmware Features Activated ?

Any installation or maintenance procedures regarding the ICP Controller are carried out with the configuration program **GDTSETUP**. The monitoring program **GDTMON** allows a continuous monitoring and maintenance of the ICP Controller and the connected disk arrays. The GDTMON utility also includes options to replace a defective drive with a new one (Hot Plug) and is available for most of the operating systems supported by the ICP Controllers. GDTSETUP allows you to set up single disks or complex disk arrays with simple and user-friendly installation procedures. Little previous knowledge is needed to be able to use GDTSETUP efficiently. It is only necessary to understand the hierarchy levels in the ICP Controller firmware (which are the same for both firmware versions: Standard and RAIDYNE).
For the user's convenience the GDTSETUP program is available in two different variants:

- GDTSETUP loaded from the ICP Controller's Flash-RAM after switching on the computer
- GDTSETUP loaded from disk under MS-DOS.

The header of the GDTSETUP program indicates with a letter after the version number whether GDTSETUP was loaded from disk or from Flash-RAM:

"**R**" for GDTSETUP loaded from the Flash-RAM after switching on the computer
"**D**" for GDTSETUP loaded from Disk, i.e., under MS-DOS.

Loading GDTSETUP with <CTRL><G> from the Flash-RAM is very comfortable since no operating system is required to carry out the configuration and setup works.

On the other side, loading GDTSETUP from disk (i.e., under MS-DOS) becomes necessary for tasks like partitioning or enabling a totally disabled GDT BIOS (which includes GDTSETUP).

C.3.1 The Express Setup Function of GDTSETUP

Whenever you load GDTSETUP and select the desired ICP Controller, it comes up in its EXPRESS Setup mode. This mode does not require any previous knowledge. If you choose this function, GDTSETUP carries out the complete installation entirely on its own, providing you for example with a fully operational RAID 5 Array Drive with optimized settings (for instance, with all SCSI features of a given drive activated).

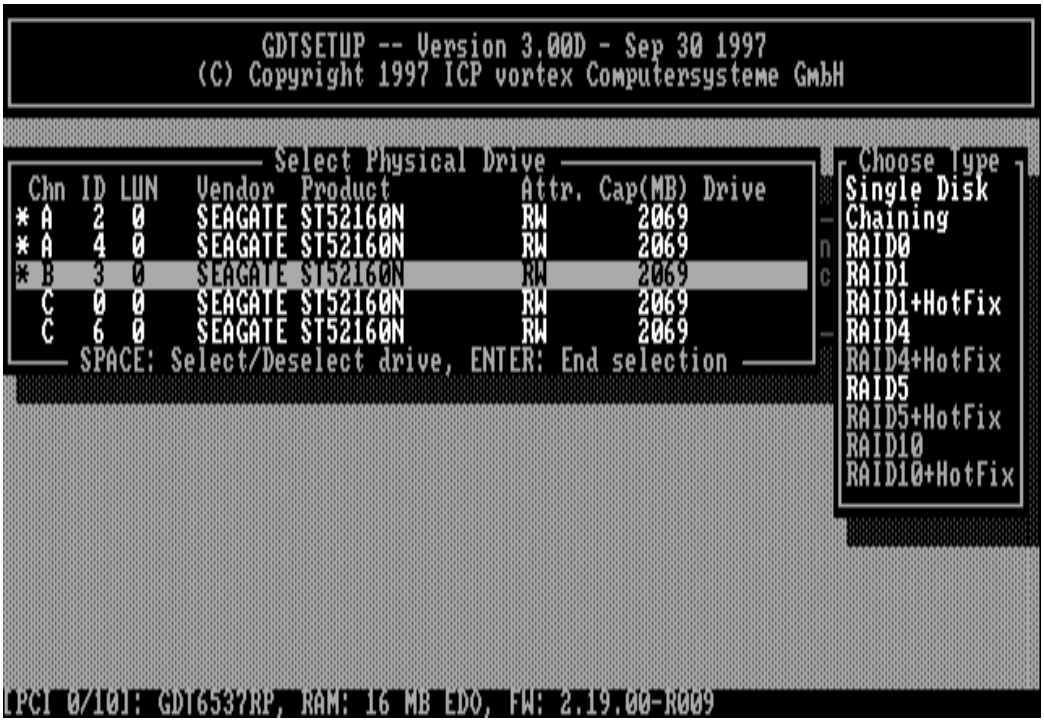
GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Express Setup
Configure Host Drives
F2: Advanced Setup
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

After selecting *Configure Host Drives*, select *Create new Host Drive*.

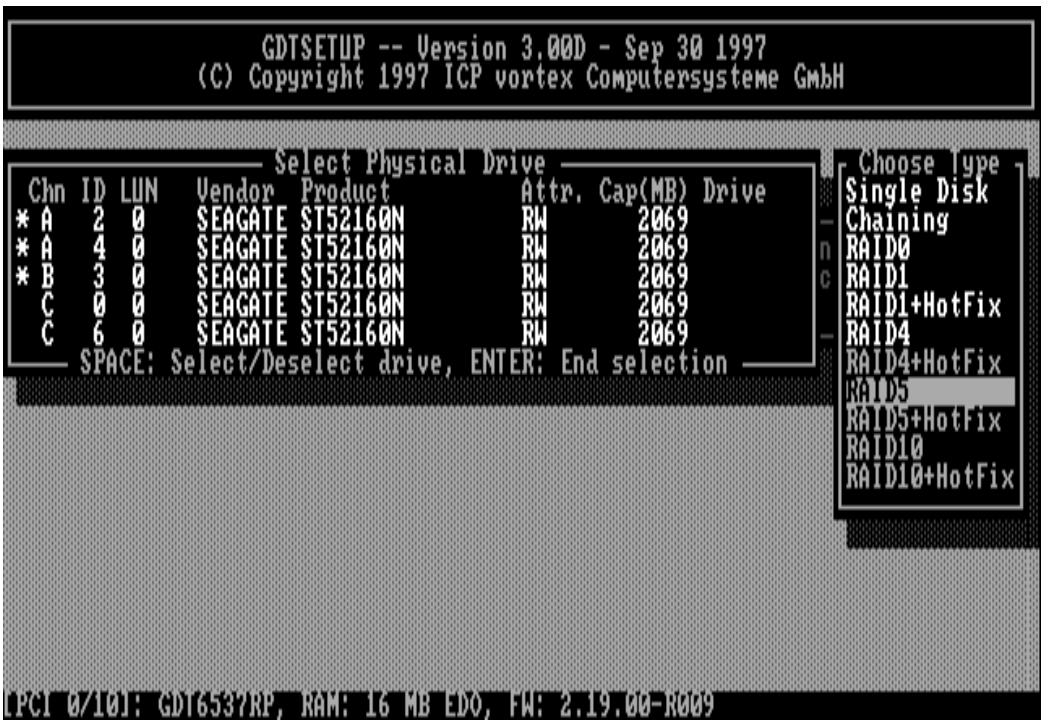
GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Express Setup
Configure Host Drives
Select Host Drive
No. Name Status Attrib. Capacity Type belongs to
0 DISK_A0 ok [RW] 99 MB Disk Logical 0
Create new Host Drive
F2: Drive Information, F10: Refresh
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

GDTSETUP scans the system for "free" hard disks (i.e., drives which are not yet part of other

Host Drives). Use the <SPACE>-bar to select the desired hard disks (they are marked with an "*"). On the right side GDTSETUP offers highlighted the possible configurations with these drives.


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Select Physical Drive
Chn ID LUN Vendor Product Attr. Cap(MB) Drive
* A 2 0 SEAGATE ST52160N RW 2069
* A 4 0 SEAGATE ST52160N RW 2069
* B 3 0 SEAGATE ST52160N RW 2069
C 0 0 SEAGATE ST52160N RW 2069
C 6 0 SEAGATE ST52160N RW 2069
SPACE: Select/Deselect drive, ENTER: End selection
Choose Type
Single Disk
Chaining
RAID0
RAID1
RAID1+HotFix
RAID4
RAID4+HotFix
RAID5
RAID5+HotFix
RAID10
RAID10+HotFix
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

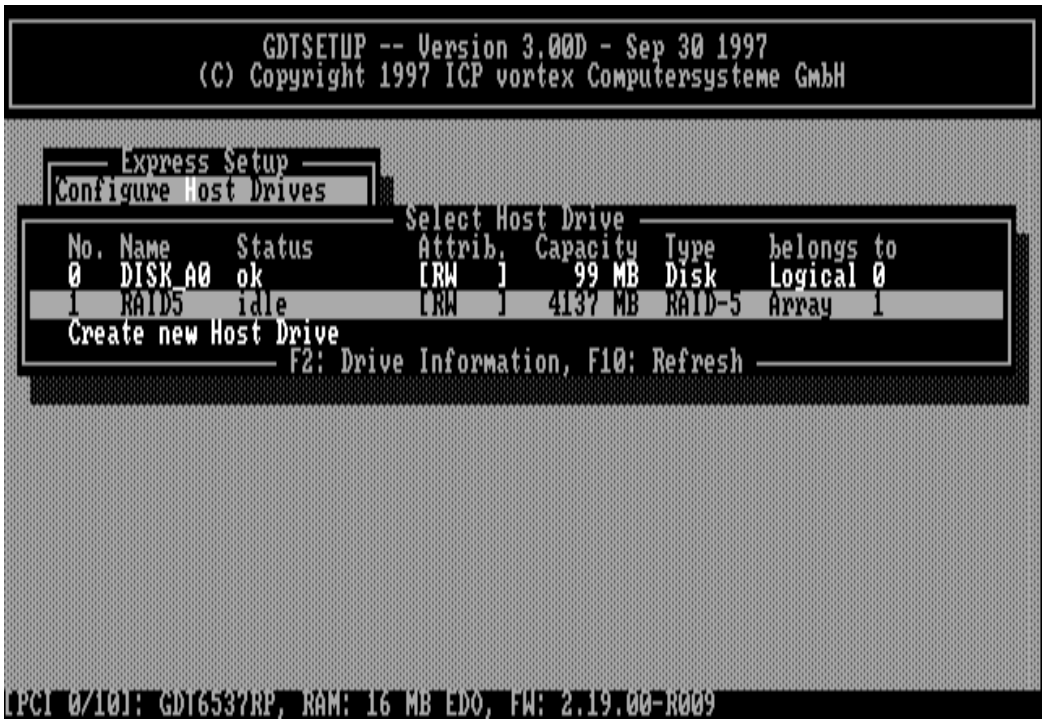
Pressing <ENTER> ends the selection.


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Select Physical Drive
Chn ID LUN Vendor Product Attr. Cap(MB) Drive
* A 2 0 SEAGATE ST52160N RW 2069
* A 4 0 SEAGATE ST52160N RW 2069
* B 3 0 SEAGATE ST52160N RW 2069
C 0 0 SEAGATE ST52160N RW 2069
C 6 0 SEAGATE ST52160N RW 2069
SPACE: Select/Deselect drive, ENTER: End selection
Choose Type
Single Disk
Chaining
RAID0
RAID1
RAID1+HotFix
RAID4
RAID4+HotFix
RAID5
RAID5+HotFix
RAID10
RAID10+HotFix
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

After choosing a configuration type for an Array Drive, GDTSETUP displays a security request.

GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Select Physical Drive
Chn ID LUN Vendor Product Attr. Cap(MB) Drive
* A 2 0 SEAGATE ST52160N RW 2069
* A 4 0 SEAGATE ST52160N RW 2069
* B 3 0 SEAGATE ST52160N RW 2069
C 0
C 6
SP
Do you want to create a host drive from the selected disk(s) ?
(CAUTION: All data will be destroyed !) (Y/N)
Choose Type
Single Disk
Chaining
RAID0
RAID1
otFix
otFix
RAID5+HotFix
RAID10
RAID10+HotFix
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

After the confirmation, the Host Drive is automatically built up and configured.


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Express Setup
Configure Host Drives
Select Host Drive
No. Name Status Attrib. Capacity Type belongs to
0 DISK_A0 ok [RW] 99 MB Disk Logical 0
1 RAID5 idle [RW] 4137 MB RAID-5 Array 1
Create new Host Drive
F2: Drive Information, F10: Refresh
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

After leaving GDTSETUP the parity information is generated.

For chapter C, we do not use this function, but give detailed instructions on how to set up a single disk and disk arrays with GDTSETUP and its E*nhanced Setup*.

C.4 Levels of Hierarchy Within the GDT Firmware

Both GDT firmware versions (Standard and RAIDYNE) are based on four fundamental levels of hierarchy. Each level has its "own drives" (= components). The basic rule is:

To build up a “drive“ on a given level of hierarchy, the “drives“ of the next lower level of hierarchy are used as components.

Level 1:

Physical Drives = hard disks, removable hard disks, some MO drives [1] are located on the lowest level. They are the basic components of all "drive constructions" you can set up. However, before they can be used by the firmware, these hard disks must be "prepared", a procedure we call *initialization*. During this initialization each hard disk receives information which allows a univocal identification even if the SCSI-ID or the controller is changed. For reasons of data coherency, this information is extremely important for any drive construction consisting of more than one physical drive.

Level 2:

On the next higher level are the **Logical Drives**. Logical Drives are introduced to obtain full independence of the physical coordinates of a physical device. This is necessary to easily change the whole ICP Controller and the channels, IDs, without loosing the data and the information on a specific disk array.

Level 3:

On this level of hierarchy, the firmware forms the **Array Drives**. Depending on the firmware installed, this can be

- Single Disks (one hard disk, some vendors call it JBOD - Just A Bunch Of Drives)
- Chaining Sets (concatenation of several hard disks)
- RAID 0 Array Drives
- RAID 1 Array Drives, RAID 1 Array Drives plus hot fix drive
- RAID 4 Array Drives, RAID 4 Array Drives plus hot fix drive
- RAID 5 Array Drives, RAID 5 Array Drives plus hot fix drive
- RAID 10 Array Drives, RAID 10 Array Drives plus hot fix drive

Level 4:

On the highest level of hierarchy, the firmware forms the **Host Drives**. In the end, only these Host Drives can be accessed by the host operating system of the computer. Drives C, D, etc. under MS-DOS, OS/2, etc. are always referred to as Host Drives by the firmware. The same applies to NetWare- and UNIX-drives. The firmware automatically transforms each newly installed Logical Drive and Array Drive into a Host Drive. This Host Drive is then assigned a Host Drive number which is identical to its Logical Drive or Array Drive number. The firmware is capable of running several Host Drives of the most various kinds at the same time. An example for MS-DOS: drive C is a RAID 5 type Host Drive (consisting of 5 SCSI hard disks), drive D is a single hard disk, and drive E is a CD-ROM communicating with RAIDYNE through corelSCSI and the GDT ASPI manager.
On this level the user may split an existing Array Drive into several Host Drives.
After a capacity expansion of a given Array Drive the added capacity appears as a new Host Drive on this level. It can be either used as a separate Host Drive, or merged with the first Host Drive of the Array Drive.

[1] Also see section C.5.

Within GDTSETUP, each level of hierarchy has its own special menu:

Level 1	⇨	Menu: ***Configure Physical Devices***
Level 2	⇨	Menu: ***Configure Logical Drives***
Level 3	⇨	Menu: ***Configure Array Drives***
Level 4	⇨	Menu: ***Configure Host Drives***

Generally, each installation procedure passes through these 4 menus, starting with level 1.

Therefore:

- First initialize the Physical Drives.
- Then configure the Logical Drives.
- Then configure the Array Drives (e.g. Array Drives with RAID 0, 1, 4, 5 and 10).
- Finally, configure the Host Drives.

C.5 Using CD-ROMs, DATs, Tapes, etc.

A SCSI device that is not a SCSI hard disk or a removable hard disk, or that does not behave like one, is called a ***Not Direct Access Device***.
Such a device is **not configured with GDTSETUP and does not form a Logical or Host Drive**. SCSI devices of this kind are either operated through the ASPI interface (Advanced SCSI programming Interface) (MS-DOS, Windows, Novell NetWare or OS/2), or are directly accessed from the operating system (UNIX, Windows NT). For more information on how to use these devices, please refer to the corresponding chapters of this manual. Note: hard disks and removable hard disks are called *Direct Access Devices*. However, there are some *Not Direct Access Devices*, for instance certain MO drives, which can be operated just like removable hard disks if they have been appropriately configured before (for example by changing their jumper setting).

But enough on the dry theory. Now here are the examples which explain step by step all the necessary basics for setting up Host Drives with your ICP Controller

C.6 Example 1 - Installing a Single SCSI Hard Disk

This example is applicable to all ICP Controllers.
We presume that the controller and the SCSI hard disks have been installed properly.

Step 1: Loading GDTSETUP

You can load GDTSETUP in two ways:

1. Press the <CTRL><G> key combination when the GDT BIOS message comes up (shortly after switching on the computer) and load GDTSETUP from the Flash-RAM of the ICP Controller. In this case no operating system is required.
   If GDTSETUP was loaded this way, there is an "R" (ROM) behind the version number.

2. Load GDTSETUP from disk under MS-DOS. Boot the MS-DOS-operating system (either from a boot-floppy or from an already existing boot drive, i.e., IDE-hard disk etc.). In order for GDTSETUP to work properly, you have to load the device driver GDTX000 first. This can be done in two ways:

   a.) Load GDTX000 from the DOS-command level by typing in GDTX000<ENTER>

b.) Load GDTX000 automatically through the CONFIG.SYS file (DEVICE=GDTX000.EXE)

Note: GDTSETUP.EXE as well as GDTX000.EXE are on the *System Disk* - DOS.

If GDTSETUP was loaded this way, there is a "D" (Disk) behind the version number.

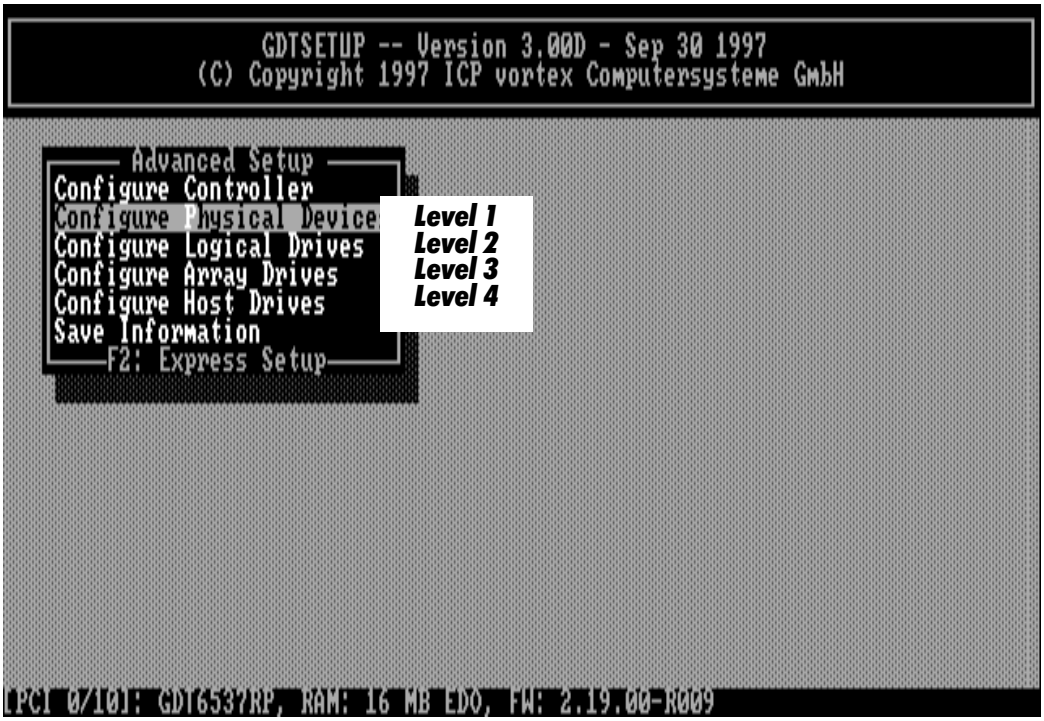
You may now ask what are the differences between the two GDTSETUP variants ?
They are small. The GDTSETUP variant loadable from disk under MS-DOS also additionally allows the partitioning of Host Drives, which is not possible with GDTSETUP loaded from the Flash-RAM. Loading GDTSETUP from the Flash-RAM is pretty easy, since there is nothing more required to configure the disk arrays. User's, who have for instance, an NT installation without a DOS partition, will highly appreciate this Flash-RAM-resident GDTSETUP.

For our example, it is not relevant whether we load GDTSETUP from the Flash-RAM, or from disk.

Now load GDTSETUP. The first menu asks you to select the desired ICP Controller. In our example, there is only one ICP Controller installed in the system. Therefore, simply press <ENTER> and then <F2> to select the Advanced Setup.

GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Select Controller
No. Name Position Features Firmware
0 GDT6537RP [PCI 0/10] C M R 2.19.00-R009
Features: C:Chaining, S:RAID-0, M:RAID-1, R:RAID-4/5/10

The main menu gives you the following options. As mentioned before, we have to go through levels 1 to 4 to install the SCSI hard disk (with almost nothing to do on levels 3 and 4).



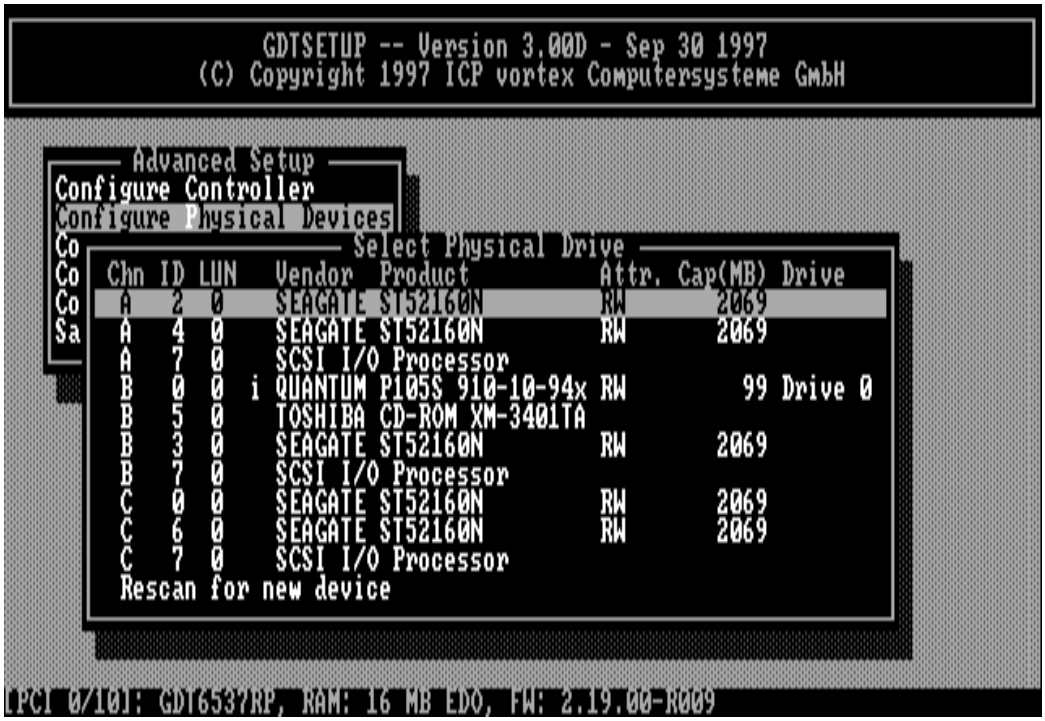
Step 2: Configure Physical Devices

Now activate the menu *Configure Physical Devices* (level 1). A list appears showing all hard disks found on the ICP Controller's SCSI channels. If you have a ICP Controller with a different number of SCSI channels, the existing SCSI channels are displayed. Note: This screen will always report all devices that are found to be connected to SCSI-cables, even though GDTSETUP only allows you to work on *Direct Access Devices* (and therefore not on tape drives, DATs, CD ROMs etc.).

The screen shows you:

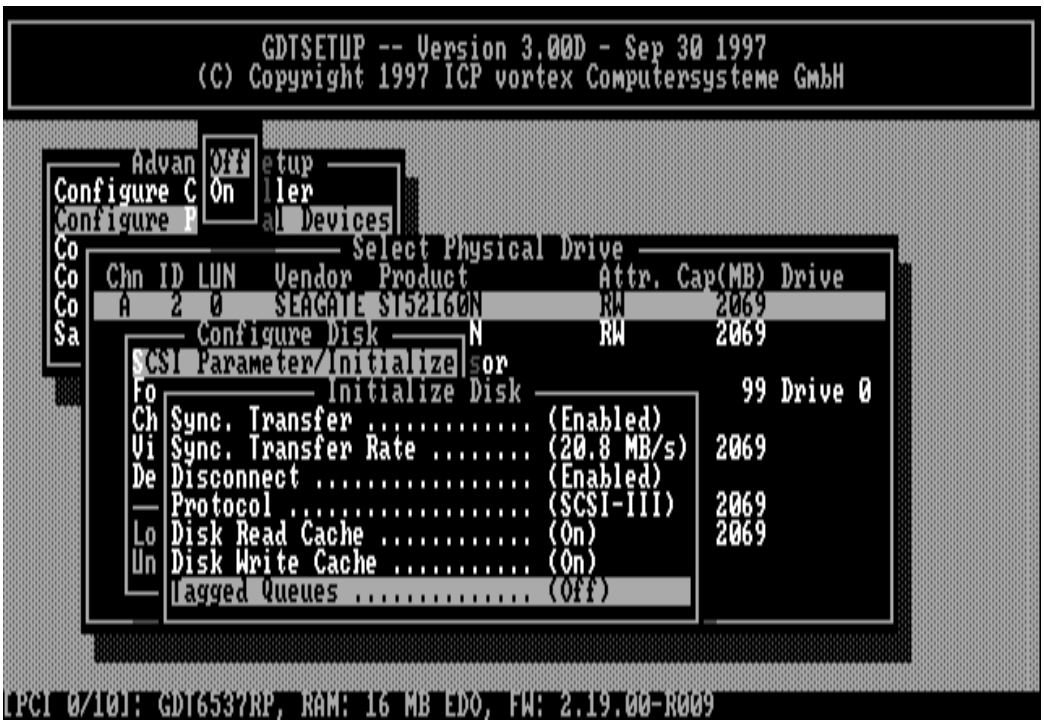
- the channel to which a SCSI device is connected
- which SCSI-ID the drive has (the entry SCSI I/O Processor stands for the corresponding SCSI channel of the ICP Controller. It has the default setting ID 7, as explained in chapter B)
- the initialization status
- the SCSI names of the drives
- the Read-Write-Status. [RW] = Read + Write
- the gross capacity
- membership in a Logical, Array or Host Drive

Use the cursor keys ↑ and ↓ to select the drive you wish to initialize. We take the first drive of channel A in the list. With this drive selected, press <ENTER>.


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Select Physical Drive
Chn ID LUN Vendor Product Attr. Cap(MB) Drive
A 2 0 SEAGATE ST52160N RW 2069
A 4 0 SEAGATE ST52160N RW 2069
A 7 0 SCSI I/O Processor
B 0 0 i QUANTUM P105S 910-10-94x RW 99 Drive 0
B 5 0 TOSHIBA CD-ROM XM-3401TA
B 3 0 SEAGATE ST52160N RW 2069
B 7 0 SCSI I/O Processor
C 0 0 SEAGATE ST52160N RW 2069
C 6 0 SEAGATE ST52160N RW 2069
C 7 0 SCSI I/O Processor
Rescan for new device
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

(Note: On Channel B, SCSI ID 0, is a drive which has been already initialized before. This is not relevant for our examples).

The *Configure Disk* menu appears which shows various options.
For our example we choose the *Initialize Disk* menu option and press <ENTER>.
The parameters within this menu can be changed by pressing <ENTER> and selecting the new setting.


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Select Physical Drive
Chn ID LUN Vendor Product Attr. Cap(MB) Drive
A 2 0 SEAGATE ST52160N RW 2069
Configure Disk
SCSI Parameter/Initialize
Initialize Disk
Sync. Transfer ..... (Enabled)
Sync. Transfer Rate ..... (20.8 MB/s)
Disconnect ..... (Enabled)
Protocol ..... (SCSI-III)
Disk Read Cache ..... (On)
Disk Write Cache ..... (On)
Tagged Queues ..... (Off)
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

1. *Sync. Transfer*: *Enable*
The SCSI-bus allows an asynchronous and a synchronous transfer. Every SCSI device must be able to perform the first type of transfer, the second one is optional. The advantage of the synchronous transfer lies in a higher data transfer rate as the signal transfer times on the possibly long SCSI-cable have no influence on the transfer rate anymore. Two SCSI-bus participants wanting to exchange data between each other have to check if and how (i.e., with which parameters) a synchronous data transfer between them is possible. Therefore, the mere setting does not automatically enable synchronous data transfer; this mode is only effective if both devices support it and after they have checked their capability of communicating with each other in this mode.

2. *Sync. Transfer Rate*
The maximum synchronous transfer rate can be limited. This limitation may become necessary if a particular SCSI cabling does not allow the maximum rate the drive and the controller could achieve. In our example, we leave the rate at 20.0 MB/s (for Wide SCSI at 20.0 MB/s, Wide/Ultra SCSI at 40.0 MB/s and Wide/Ultra2 SCSI 80.0 MB/s).
Note: In order to select a transfer rate above 10.0 MB/s the Protocol has to be set to SCSI-III.

3. *Disconnect*: *Enable*
The concept of the SCSI-bus allows several participants. All these participants should be able to use the bus in a manner that causes the least reciprocal disturbance or obstruction. A participant should therefore vacate the bus if he does not need it. For reasons of performance, it is particularly important to guarantee a high degree of overlapping of the actions on the SCSI-bus. This high degree of overlapping can be achieved if a SCSI device is allowed to disconnect, thus leaving the bus to be used by other participants. If there is only one SCSI device connected to the SCSI-bus, Disconnect should be disabled.

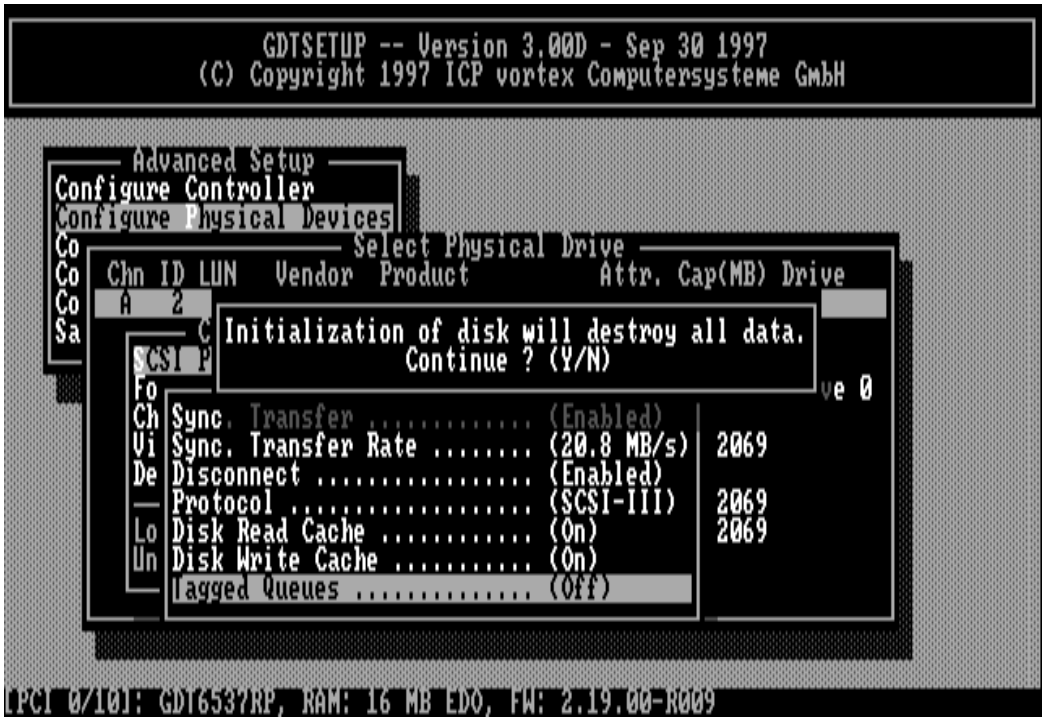
4. *Protocol*
This can be either SCSI-II or SCSI-III.
If you select SCSI-III make sure, that your hard disk supports this protocol. Most new multi-GB hard disks support SCSI-III. To enable Ultra (FAST-20) and Ultra2 (FAST-40) transfer rates (Wide/Ultra: 40 MB/s; Wide/Ultra2: 80 MB/s) SCSI-III protocol is required.

5. *Disk Read Cache / Disk Write Cache / Tagged Queues*
If a drive supports particular SCSI features you enable them (On).
Note: Most of the modern drives support disk caching (read and write). Some do not support Tagged Queues.

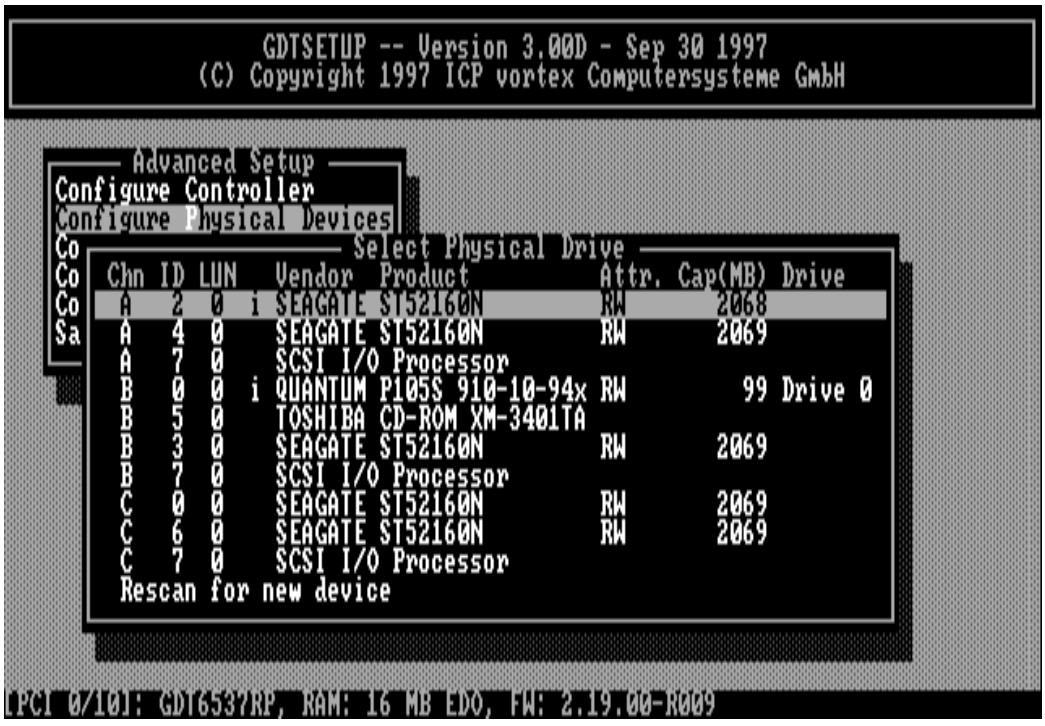
Press <ESC> to leave the *Initialize Disk* menu.
GDTSETUP displays a warning on the destruction of all data. This implies two different evaluations, according to the drive's current state and the options you have selected:

1. *First Initialization of the* SCSI *Device.*
   In this case the warning must be taken seriously. If the drive was previously connected to a different controller (e.g., NCR etc.) and still contains data, this data will be lost now.

2. *The* SCSI *Device was already initialized.*
   If only internal parameters, such as Disconnect, Synchronous Transfer and SCSI-II options have been changed, the data on the drive remains intact. Only the function state of the device is changed.


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Select Physical Drive
Chn ID LUN Vendor Product Attr. Cap(MB) Drive
A 2
Initialization of disk will destroy all data.
Continue ? (Y/N)
Sync. Transfer ..... (Enabled)
Sync. Transfer Rate ..... (20.8 MB/s) 2069
Disconnect ..... (Enabled)
Protocol ..... (SCSI-III) 2069
Disk Read Cache ..... (On) 2069
Disk Write Cache ..... (On)
Tagged Queues ..... (Off)
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

Press <Y> and we are back on the main screen of level 1 and see that the initialization-status of the SCSI device has changed.

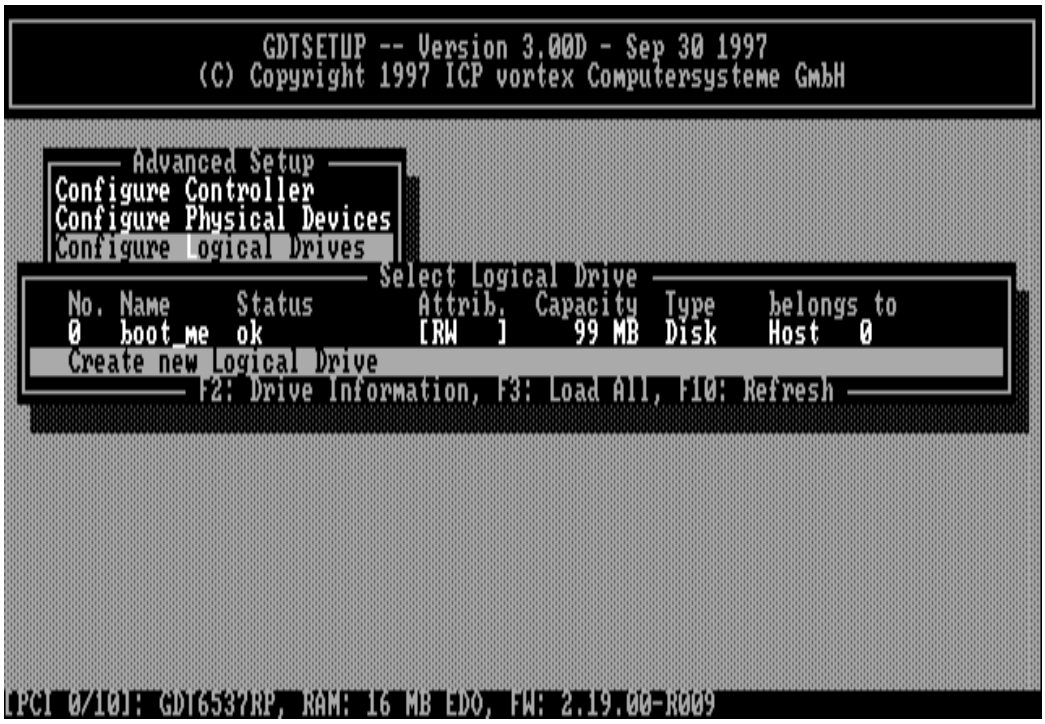

GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Select Physical Drive
Chn ID LUN Vendor Product Attr. Cap(MB) Drive
A 2 0 i SEAGATE ST52160N RW 2068
A 4 0 SEAGATE ST52160N RW 2069
A 7 0 SCSI I/O Processor
B 0 0 i QUANTUM P105S 910-10-94x RW 99 Drive 0
B 5 0 TOSHIBA CD-ROM XM-3401TA
B 3 0 SEAGATE ST52160N RW 2069
B 7 0 SCSI I/O Processor
C 0 0 SEAGATE ST52160N RW 2069
C 6 0 SEAGATE ST52160N RW 2069
C 7 0 SCSI I/O Processor
Rescan for new device
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

Step 3: Configure Logical Drives

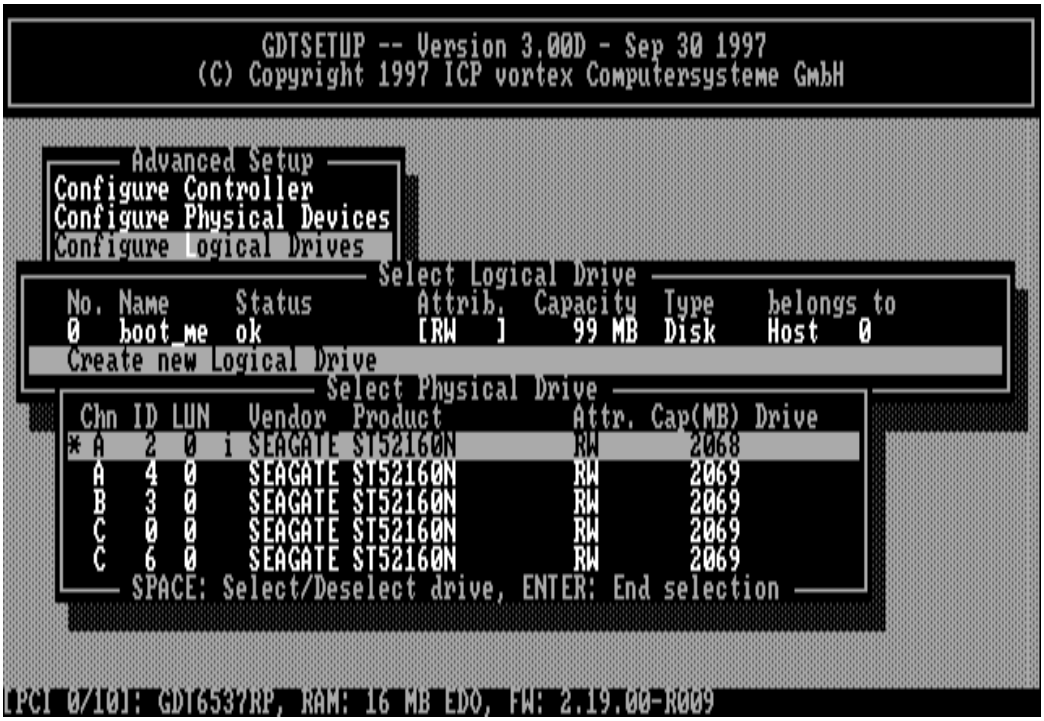
We now leave level 1 (by pressing the <ESC>-key) and are back in the main menu. Now, with the cursor keys ↑ and ↓ select *Configure Logical Drives* and go to level 2 by pressing <ENTER>.

GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Configure Array Drives
Configure Host Drives
Save Information
F2: Express Setup
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

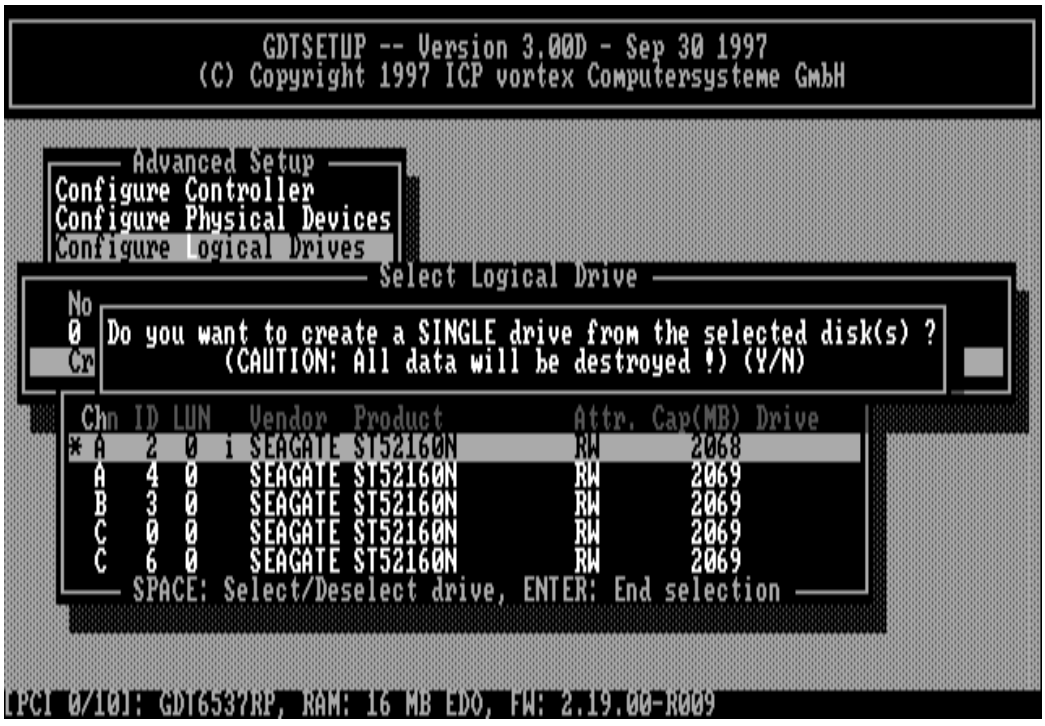
The main screen of level 2 appears. Move the selection bar to C*reate new* L*ogical* D*rive* and press <ENTER> .


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Select Logical Drive
No. Name Status Attrib. Capacity Type belongs to
0 boot_me ok [RW] 99 MB Disk Host 0
Create new Logical Drive
F2: Drive Information, F3: Load All, F10: Refresh
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

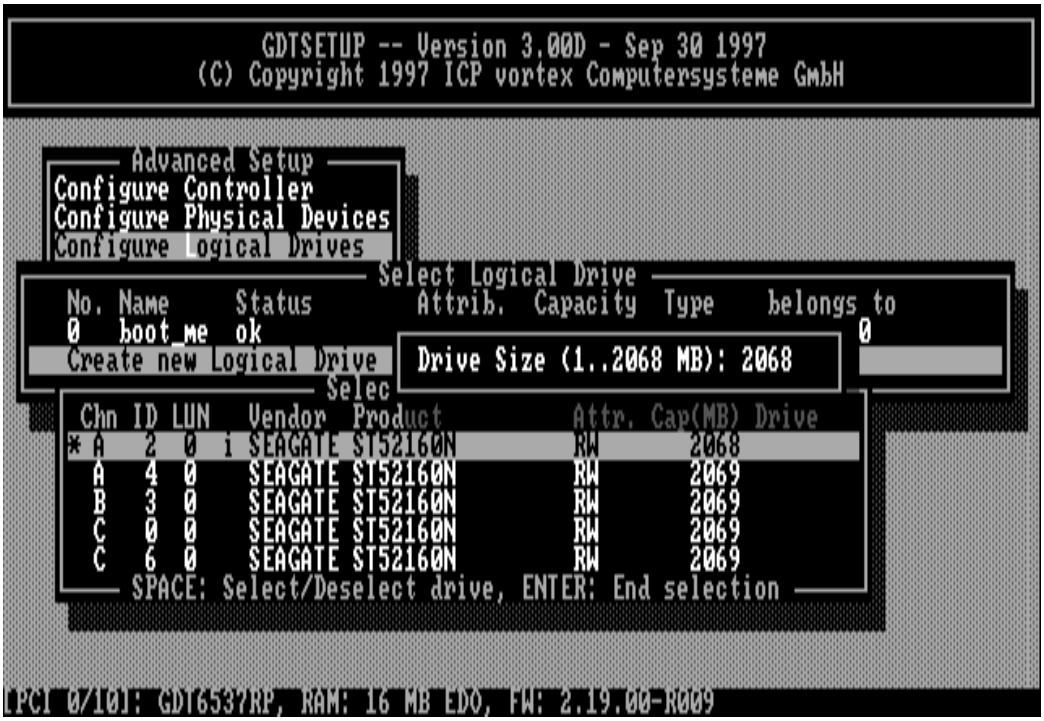
Note: The already existing Logical Drive in this list has no relevance for our example.


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Select Logical Drive
No. Name Status Attrib. Capacity Type belongs to
0 boot_me ok [RW] 99 MB Disk Host 0
Create new Logical Drive
Select Physical Drive
Chn ID LUN Vendor Product Attr. Cap(MB) Drive
* A 2 0 i SEAGATE ST52160N RW 2068
A 4 0 SEAGATE ST52160N RW 2069
B 3 0 SEAGATE ST52160N RW 2069
C 0 0 SEAGATE ST52160N RW 2069
C 6 0 SEAGATE ST52160N RW 2069
SPACE: Select/Deselect drive, ENTER: End selection
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

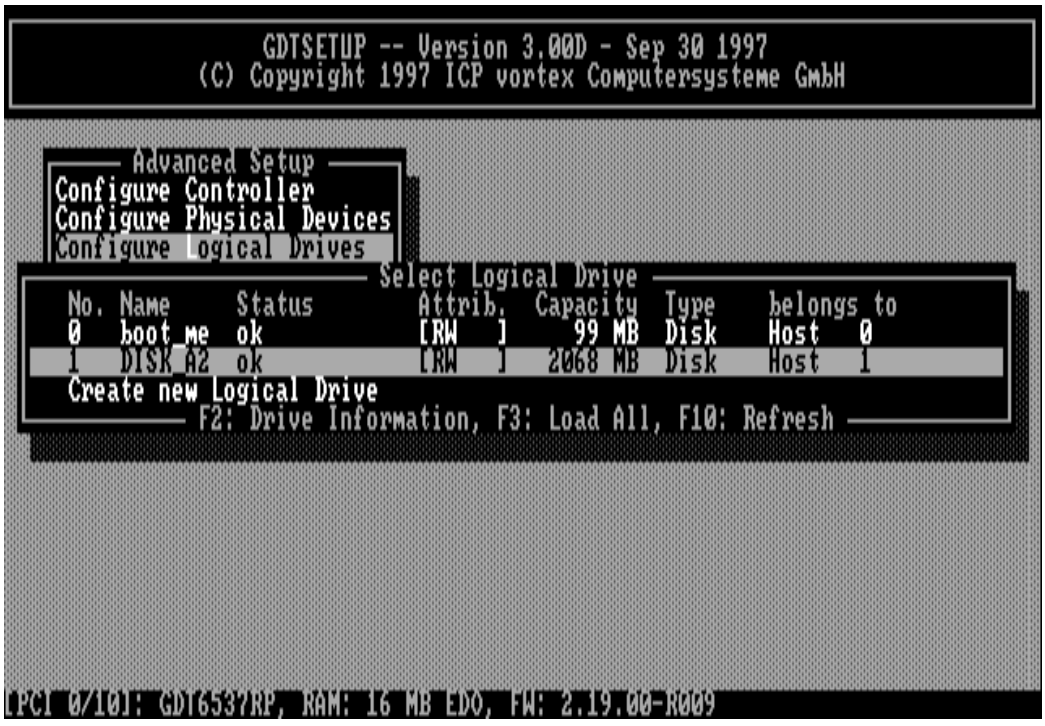
Select the initialized hard disk with the <SPACE>-bar (it becomes marked with an "*") and press <ENTER>.


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Select Logical Drive
No
0
Cr
Do you want to create a SINGLE drive from the selected disk(s) ?
(CAUTION: All data will be destroyed !) (Y/N)
Chn ID LUN Vendor Product Attr. Cap(MB) Drive
* A 2 0 i SEAGATE ST52160N RW 2068
A 4 0 SEAGATE ST52160N RW 2069
B 3 0 SEAGATE ST52160N RW 2069
C 0 0 SEAGATE ST52160N RW 2069
C 6 0 SEAGATE ST52160N RW 2069
SPACE: Select/Deselect drive, ENTER: End selection
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

For security reasons, you will be asked again if you want to use the selected disk to create a Logical Drive.
As we are sure of our choice, we confirm with <Yes>. GDTSETUP allows you to limit the hard disk size for this Logical Drive. This becomes interesting when you configure disk arrays. For this example we use the full capacity and press <ENTER> .


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Select Logical Drive
No. Name Status Attrib. Capacity Type belongs to
0 boot_me ok 0
Create new Logical Drive
Drive Size (1..2068 MB): 2068
Chn ID LUN Vendor Product Attr. Cap(MB) Drive
* A 2 0 i SEAGATE ST52160N RW 2068
A 4 0 SEAGATE ST52160N RW 2069
B 3 0 SEAGATE ST52160N RW 2069
C 0 0 SEAGATE ST52160N RW 2069
C 6 0 SEAGATE ST52160N RW 2069
SPACE: Select/Deselect drive, ENTER: End selection
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

The dialog box is closed and we are back in the main menu of level 2.


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Select Logical Drive
No. Name Status Attrib. Capacity Type belongs to
0 boot_me ok [RW] 99 MB Disk Host 0
1 DISK_A2 ok [RW] 2068 MB Disk Host 1
Create new Logical Drive
F2: Drive Information, F3: Load All, F10: Refresh
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

As you can see, we have already created a new Logical Drive of the type *Disk*. The name of the Logical Drive is assigned automatically and contains the channel description and the SCSI-ID after the "_" . This can serve as a reminder when you install a complex system with many drives. (Naturally, you may change the name.)
This concludes the installation on level 2. Now press the <ESC>-key to leave this screen.

Since we have only a single disk assigned to a Logical Drive, there is nothing to do in the *Configure Array Drives* menu, thus we go directly to the *Configure Host Drives* menu and have ***no* Step 4.**

Step 5: Configure Host Drives

We are now back in the main menu of GDTSETUP and select *Configure Host Drive*.
The main screen of level 4 appears. Press <ENTER> . A list of available Host Drives is displayed. Again, the first entry is not relevant for our example.
At position 1 we find our previously configured Logical Drive. It was automatically transformed into a Host Drive, thus for this example we have nothing to do in this menu.

GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Configure Array Drives
Configure Host Drives
Select Host Drive
No. Name Status Attrib. Capacity Type belongs to
0 DISK_A0 ok [RW] 99 MB Disk Logical 0
1 DISK_A2 ok [RW] 2068 MB Disk Logical 1
Create new Host Drive
F2: Drive Information, F10: Refresh
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

Press <ENTER> to get a list of possible menu options.

GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Host Drive
Change Drive Name
Swap Host Drives
Remove Host Drive
Split Host Drive
Merge Host Drives
Partition Drive
Overwr. Master Boot Code
Select Host Drive
Attrib. Capacity Type belongs to
[RW] 99 MB Disk Logical 0
[RW] 2068 MB Disk Logical 1
F2: Drive Information, F10: Refresh
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

We should not forget to mention, that if you would have selected C*reate new* H*ost* D*rive*, this would have lead you to the same menu as the Express Setup mode.
But this example is an exercise which should help you to gain a better understanding of how the ICP Controller and GDTSETUP work. So don't believe we let you do redundant homework.
By the way, if you have loaded GDTSETUP from the Flash-RAM (<CTRL><G>) the P*artition* D*rive* option will be missing in this menu. The reason is that partitioning makes no sense when there is not an operating system loaded and the INT13H extension of the ICP Controller has not yet been activated.

Step 6: Leaving GDTSETUP

We are now back in the main menu of GDTSETUP. The installation is completed, and we therefore leave GDTSETUP by pressing the <ESC>-key. The following message appears:

GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Configuration of drive(s) was modified.
System will be rebooted.
Press any key to reboot !

As we are done with the installation and therefore definitely want to leave GDTSETUP, we press any key.

IMPORTANT: Always end GDTSETUP by leaving the program in the regular way (do not warm-boot with CTRL-ALT-DEL or cold boot by pressing the RESET button). Certain information is only transferred to the controller when you leave GDTSETUP in the regular way.

The Host Drive we have configured in this example is now ready for the installation of the desired operating system.

C.7 Example 2 - Installing a Mirroring Array - RAID 1

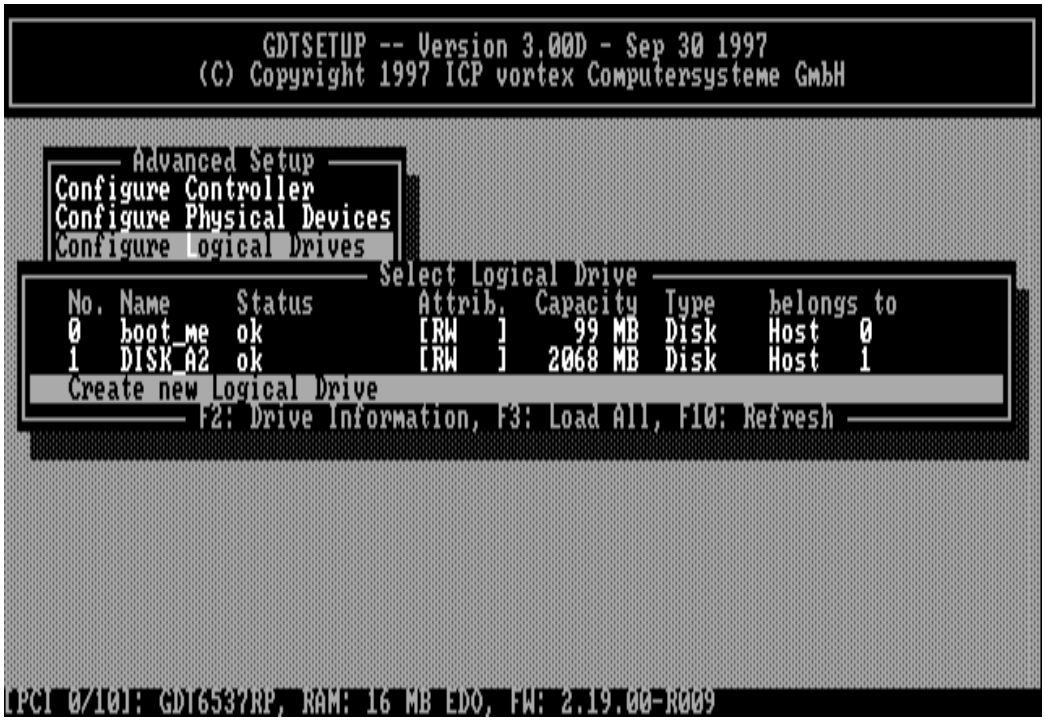
This example is applicable to all ICP Controllers.
It is our intention to install a Mirroring Array consisting of two identical hard disks. In the classical terminology of the RAID levels this is called a RAID 1 disk array.
We presume that the controller and the SCSI hard disks have been properly installed. **Step 1** of the installation is the same as in the first example, therefore we do not explain it again. **Step 2** regards the initialization of the second SCSI device. Proceed as described in the first example.

Step 3: Configure Logical Drives

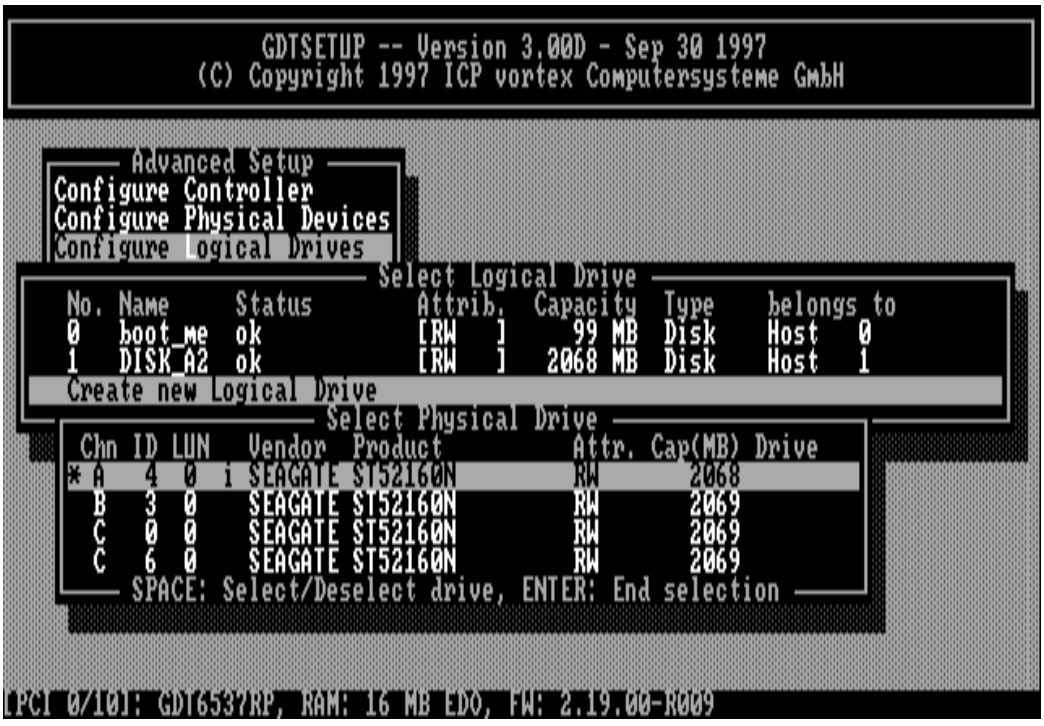
We now leave level 1 (by pressing the <ESC>-key) and are back in the main menu. Now, with the cursor keys ↑ and ↓ select *Configure Logical Drives* and go to level 2 by pressing <ENTER>.

GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Configure Array Drives
Configure Host Drives
Save Information
F2: Express Setup
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

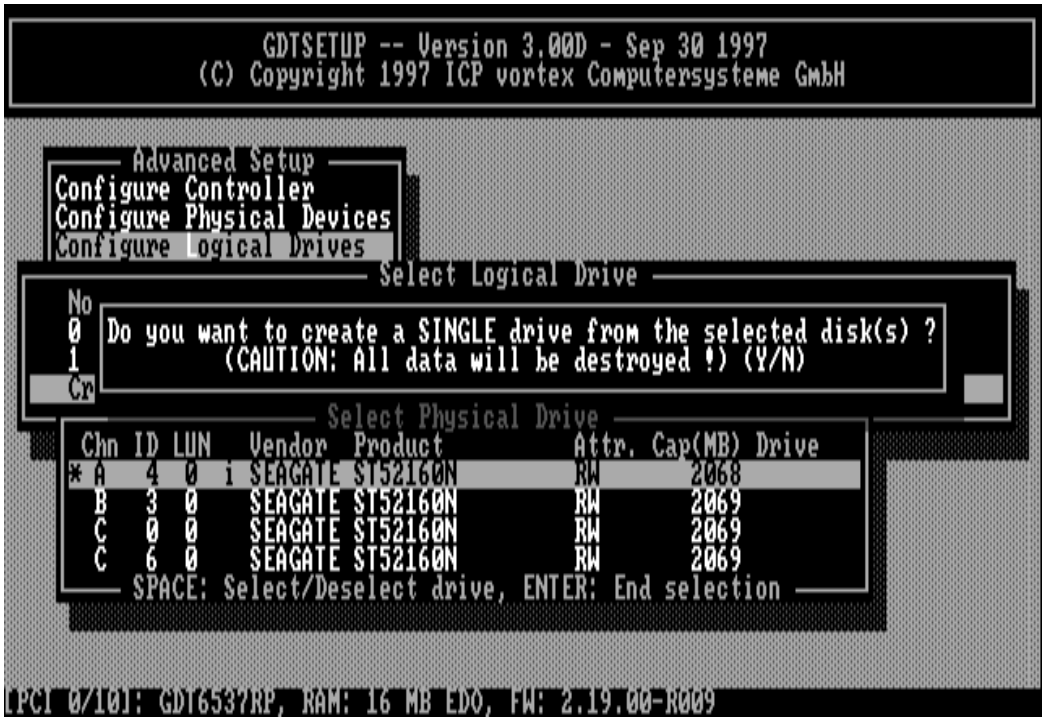
The main screen of level 2 appears. Move the selection bar to *Create new Logical Drive* and press <ENTER> .


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Select Logical Drive
No. Name Status Attrib. Capacity Type belongs to
0 boot_me ok [RW] 99 MB Disk Host 0
1 DISK_A2 ok [RW] 2068 MB Disk Host 1
Create new Logical Drive
F2: Drive Information, F3: Load All, F10: Refresh
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

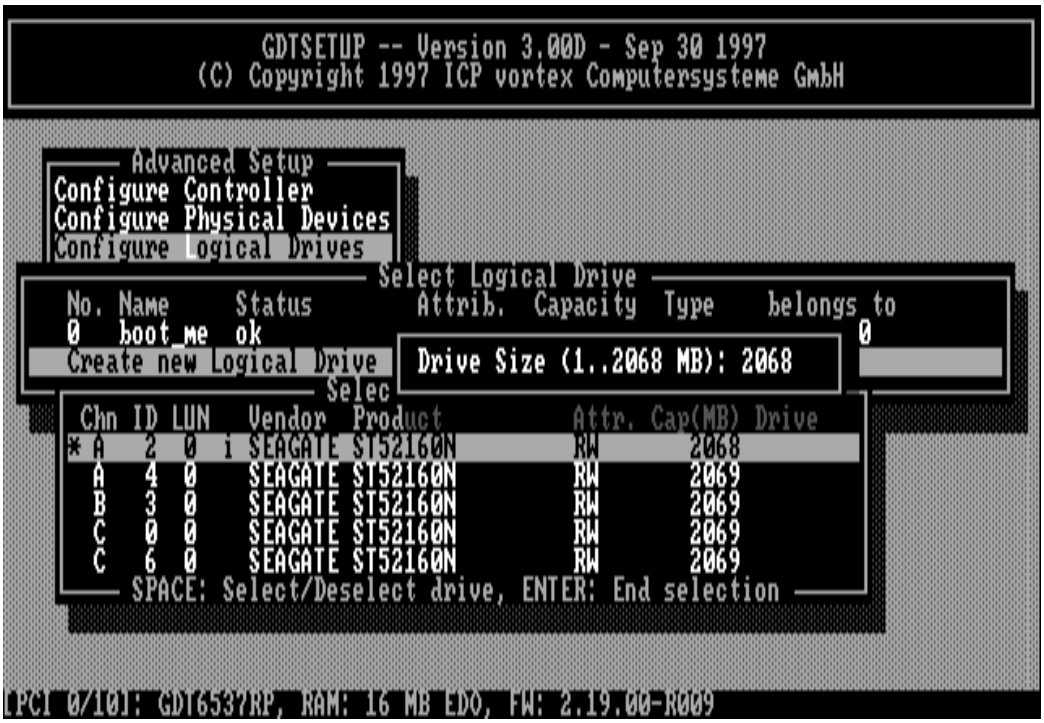
Note: The already existing Logical Drive in the first position of this list has no relevance for our example. The second entry was created before.


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Select Logical Drive
No. Name Status Attrib. Capacity Type belongs to
0 boot_me ok [RW] 99 MB Disk Host 0
1 DISK_A2 ok [RW] 2068 MB Disk Host 1
Create new Logical Drive
Select Physical Drive
Chn ID LUN Vendor Product Attr. Cap(MB) Drive
* A 4 0 i SEAGATE ST52160N RW 2068
B 3 0 SEAGATE ST52160N RW 2069
C 0 0 SEAGATE ST52160N RW 2069
C 6 0 SEAGATE ST52160N RW 2069
SPACE: Select/Deselect drive, ENTER: End selection
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

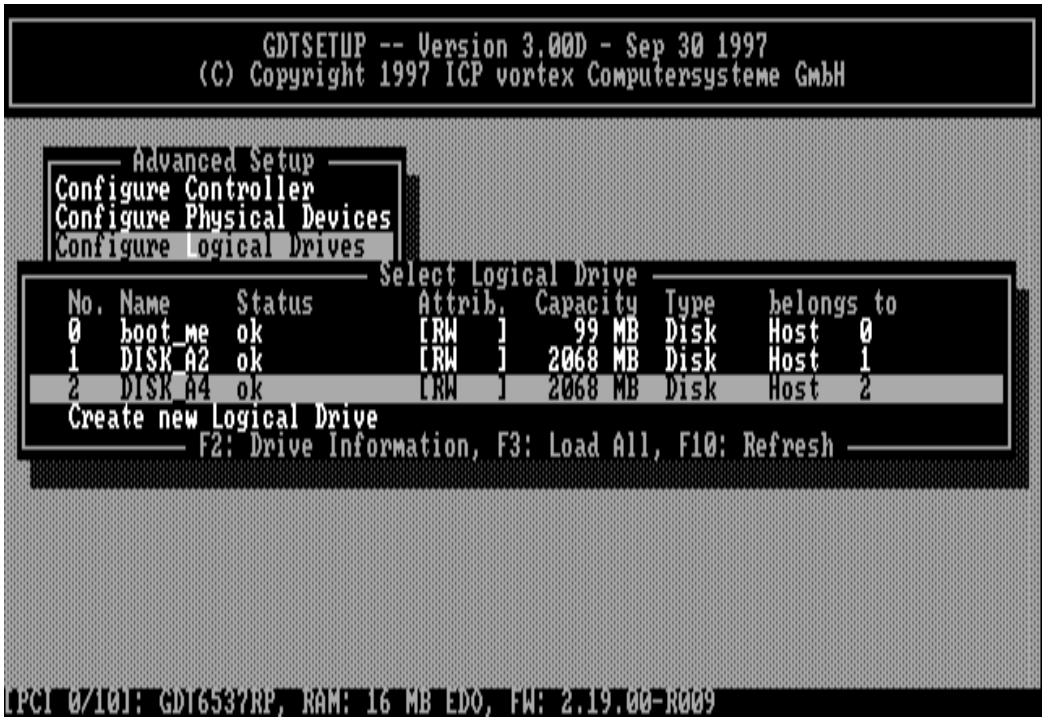
Select the initialized hard disk with the <SPACE>-bar (it becomes marked with an "*") and press <ENTER>.


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Select Logical Drive
No
0
1
Cr
Do you want to create a SINGLE drive from the selected disk(s) ?
(CAUTION: All data will be destroyed !) (Y/N)
Select Physical Drive
Chn ID LUN Vendor Product Attr. Cap(MB) Drive
* A 4 0 i SEAGATE ST52160N RW 2068
B 3 0 SEAGATE ST52160N RW 2069
C 0 0 SEAGATE ST52160N RW 2069
C 6 0 SEAGATE ST52160N RW 2069
SPACE: Select/Deselect drive, ENTER: End selection
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

For security reasons, you will be asked again if you want to use the selected disk to create a Logical Drive.
As we are sure of our choice, we confirm with <Yes>. GDTSETUP allows you to limit the hard disk size for this Logical Drive. This becomes interesting when you configure disk arrays. For this example we use the full capacity and press <ENTER> .


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Select Logical Drive
No. Name Status Attrib. Capacity Type belongs to
0 boot_me ok 0
Create new Logical Drive
Drive Size (1..2068 MB): 2068
Chn ID LUN Vendor Product Attr. Cap(MB) Drive
* A 2 0 i SEAGATE ST52160N RW 2068
A 4 0 SEAGATE ST52160N RW 2069
B 3 0 SEAGATE ST52160N RW 2069
C 0 0 SEAGATE ST52160N RW 2069
C 6 0 SEAGATE ST52160N RW 2069
SPACE: Select/Deselect drive, ENTER: End selection
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

The dialog box is closed and we are back in the main menu of level 2.

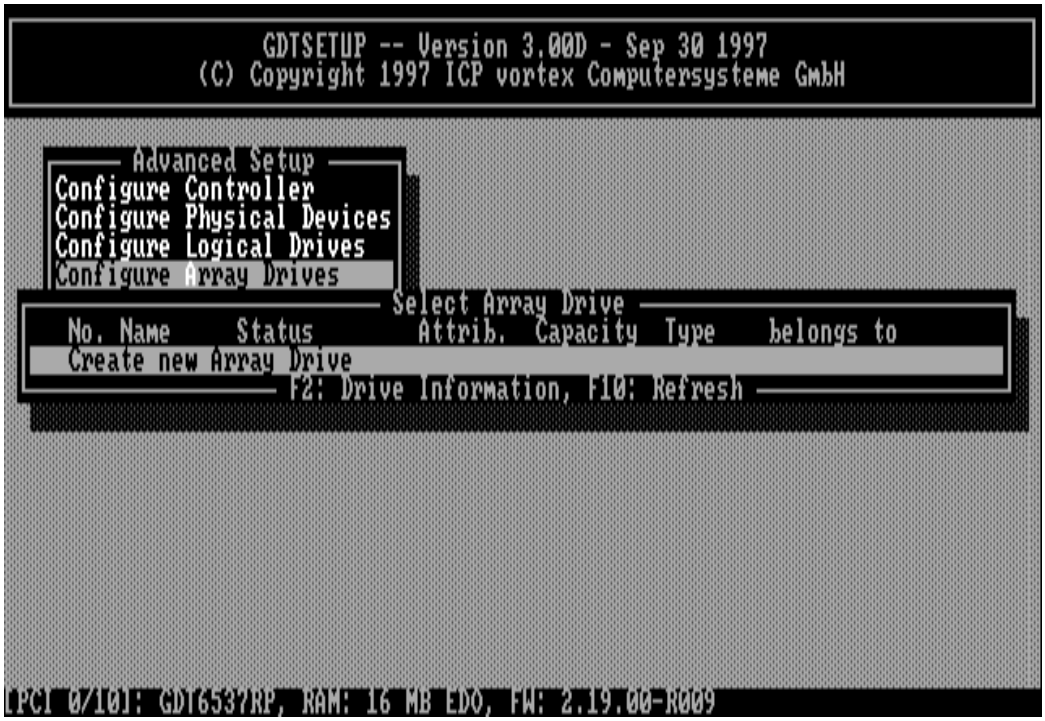

GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Select Logical Drive
No. Name Status Attrib. Capacity Type belongs to
0 boot_me ok [RW] 99 MB Disk Host 0
1 DISK_A2 ok [RW] 2068 MB Disk Host 1
2 DISK_A4 ok [RW] 2068 MB Disk Host 2
Create new Logical Drive
F2: Drive Information, F3: Load All, F10: Refresh
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

As you can see, we have created another Logical Drive of the type D*isk*. The name of the Logical Drive is assigned automatically and contains the channel description and the SCSI-ID after the "_" . This can serve as a reminder when you install a complex system with many drives. (Naturally, you may change the name.)
This concludes the installation on level 2. Now press the <ESC>-key to leave this screen.

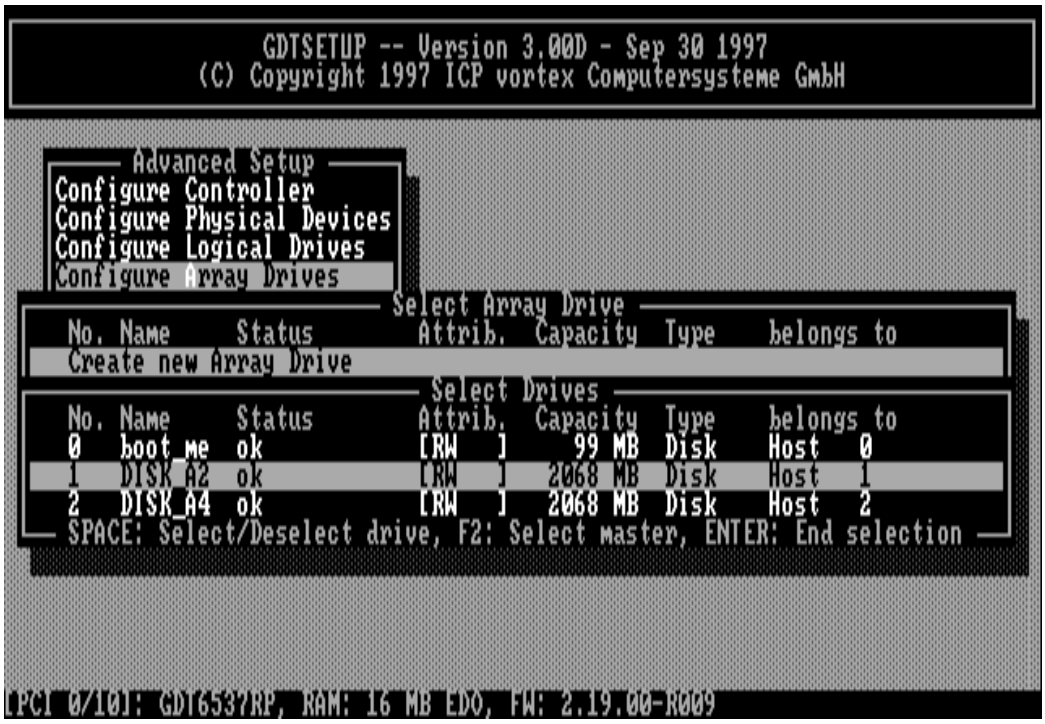
In the next step it is our objective to add the third Logical Drive in this list as a mirroring partner to the second Logical Drive of the list, thus configuring a RAID 1 disk array.

Step 4: Configure Array Drives

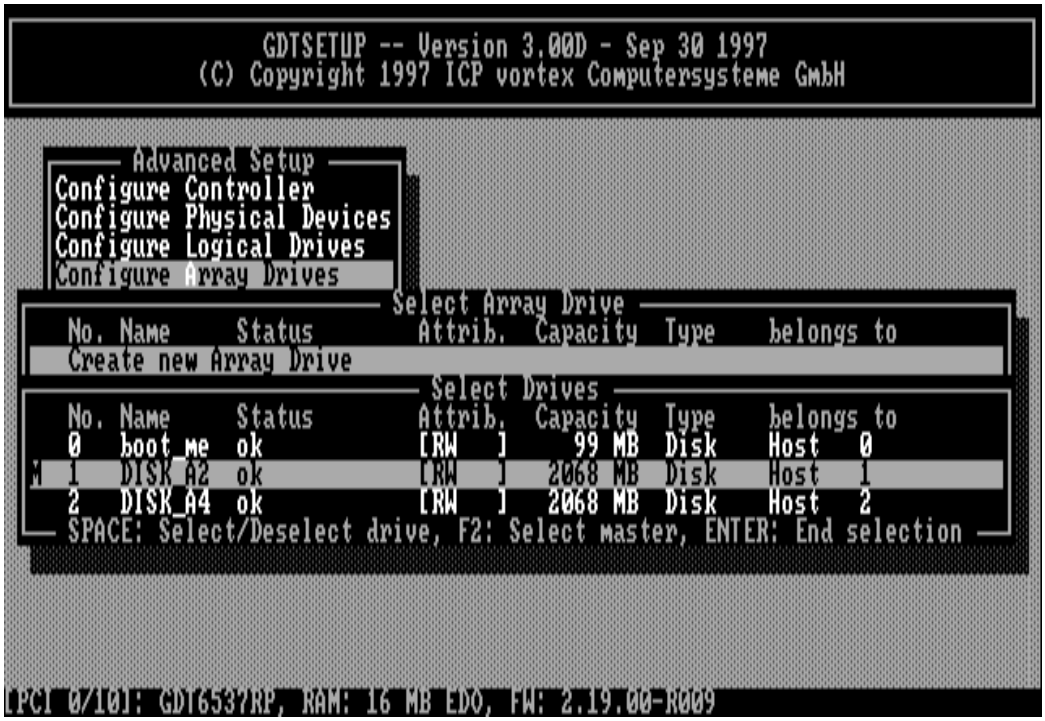
We now leave level 2 (by pressing the <ESC>-key) and are back in the main menu. Now, with the cursor keys ↑ and ↓ select C*onfigure* A*rray* D*rives* and go to level 3 by pressing <ENTER>.


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Configure Array Drives
Select Array Drive
No. Name Status Attrib. Capacity Type belongs to
Create new Array Drive
F2: Drive Information, F10: Refresh
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

Since we want to create a new Array Drive press <ENTER>.
Note: The first entry in this list has no relevance for our example.


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Configure Array Drives
Select Array Drive
No. Name Status Attrib. Capacity Type belongs to
Create new Array Drive
Select Drives
No. Name Status Attrib. Capacity Type belongs to
0 boot_me ok [RW] 99 MB Disk Host 0
1 DISK_A2 ok [RW] 2068 MB Disk Host 1
2 DISK_A4 ok [RW] 2068 MB Disk Host 2
SPACE: Select/Deselect drive, F2: Select master, ENTER: End selection
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

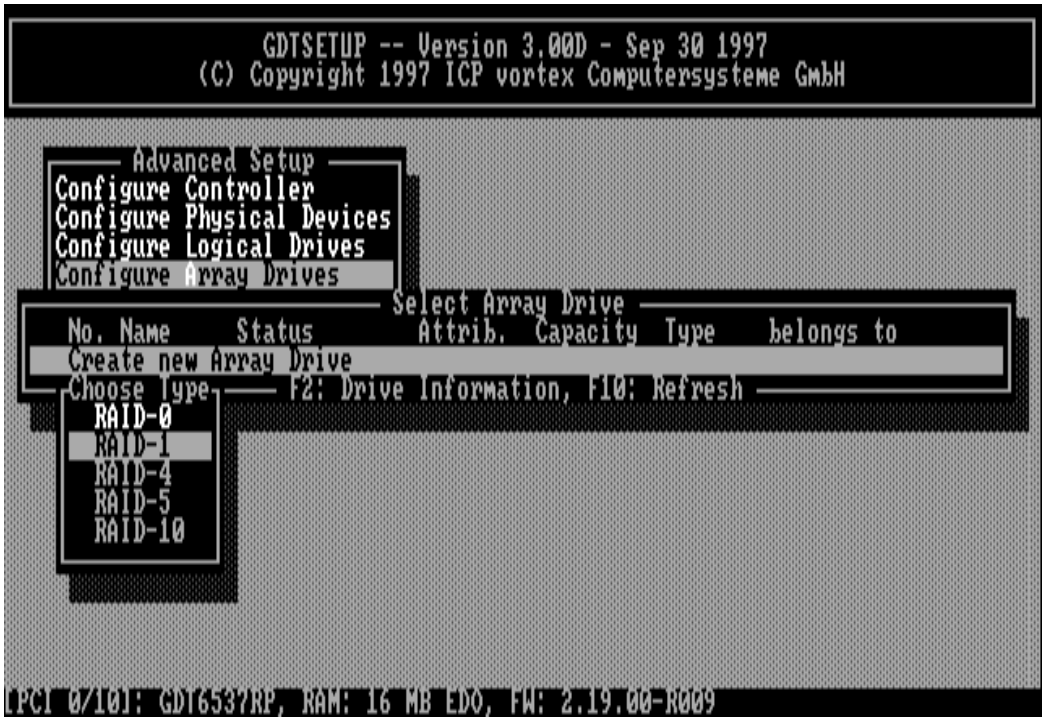
Move the selection bar to the second entry and press the <SPACE>-bar. The entry is marked with an "M" for Master. This means that the data from this Logical Drive are copied to the second Logical Drive, which we will select next.


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Configure Array Drives
Select Array Drive
No. Name Status Attrib. Capacity Type belongs to
Create new Array Drive
Select Drives
No. Name Status Attrib. Capacity Type belongs to
0 boot_me ok [RW] 99 MB Disk Host 0
M 1 DISK_A2 ok [RW] 2068 MB Disk Host 1
2 DISK_A4 ok [RW] 2068 MB Disk Host 2
SPACE: Select/Deselect drive, F2: Select master, ENTER: End selection
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

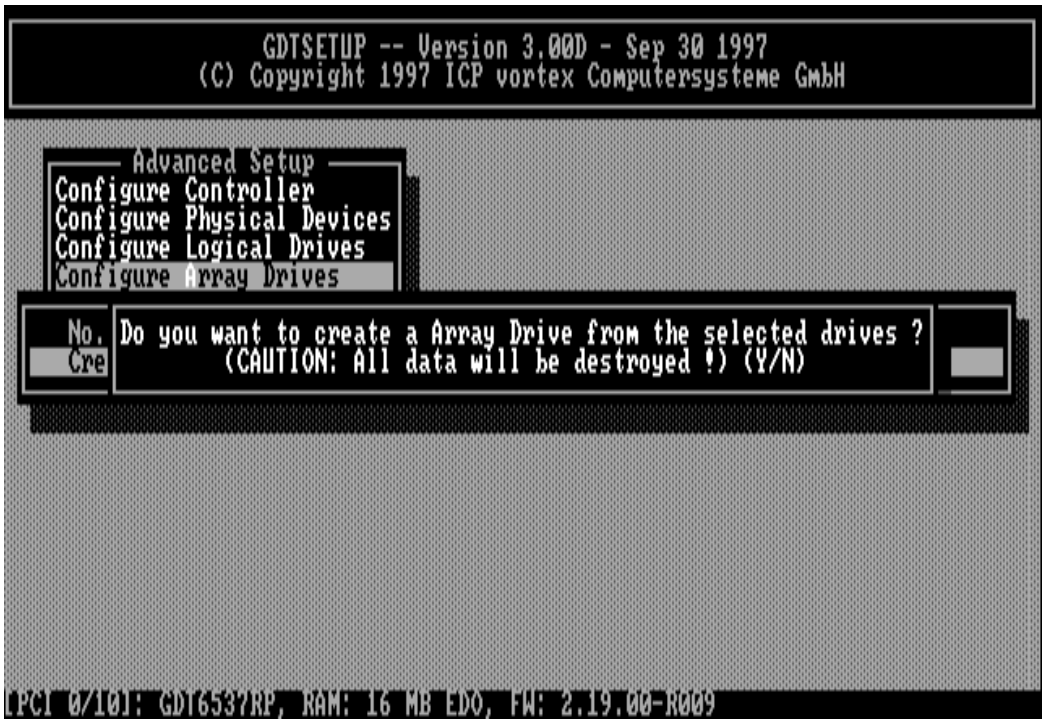
Move the selection bar with the cursor key ↓ to the next entry and press the <SPACE>-bar, again. It is marked with an "*"(pressing the <SPACE>-bar again undoes your choice).

GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Configure Array Drives
Select Array Drive
No. Name Status Attrib. Capacity Type belongs to
Create new Array Drive
Select Drives
No. Name Status Attrib. Capacity Type belongs to
0 boot_me ok [RW] 99 MB Disk Host 0
M 1 DISK_A2 ok [RW] 2068 MB Disk Host 1
* 2 DISK_A4 ok [RW] 2068 MB Disk Host 2
SPACE: Select/Deselect drive, F2: Select master, ENTER: End selection
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

When the Logical Drive is selected, confirm with <ENTER>. GDTSETUP displays now a list of possible RAID levels, available with the number of Logical Drives selected. In our case it is RAID-0 (data striping) and RAID 1. Move the selection bar to RAID-1 and press <ENTER>. (Note: RAID levels 4, 5 and 10 are only available with ICP Controllers which are equipped with the RAIDYNE firmware).



GDTSETUP displays a security request, which we answer with <Y>.


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Configure Array Drives
No.
Cre
Do you want to create a Array Drive from the selected drives ?
(CAUTION: All data will be destroyed !) (Y/N)
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

As you can easily recognize, we have created a new Array Drive of the Type RAID-1. Its state is build. When we leave GDTSETUP at the end of this example, you will see that the ICP Controller automatically copies the data of the first Logical Drive (our master) to the second Logical Drive. During this s*ynchronization* the RAID-1 array is fully operational.
The functioning of a RAID-1, or mirroring, disk array, is easy to understand: On the ICP Controller, one write-access from the host computer is transformed into two write-accesses (to both Logical Drives forming the mirroring array). If the two Logical Drives are built of hard

disks, which are connected with different SCSI channels of the ICP Controller, both write-accesses are performed simultaneously (this method is often called D*isk* D*uplexing*). During a read-access of the host computer the data will be read from the Logical Drive whose hard disk has the fastest access to the data requested.
If a hard disk should fail (for instance due to a mechanical defect), all data is still available on the other Logical Drive. In this event, the controller gives an acoustical alarm.

GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Configure Array Drives
Select Array Drive
No. Name Status Attrib. Capacity Type belongs to
1 DISK_A2 build [RW] 2068 MB RAID-1 Host 1
Create new Array Drive
F2: Drive Information, F10: Refresh
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

Steps 5 and 6 are the same as in example 1.

C.8 Example 3 - Installing a RAID 5 Disk Array

This example is applicable to ICP Controllers with the RAIDYNE firmware.
The controller we use is the ICP Controller with three SCSI channels.

C.8.1 Mechanical Structure, Electrical Connections

Whether to install the SCSI hard disks into the computer case or into a separate disk sub-system enclosure strongly depends on your individual hardware equipment, therefore we shall not discuss it here. However, it is very important that the hard disks and the ICP Controller are cooled with a sufficient and constant air flow and that the power supply of the system is strong enough for the desired configuration. You may use a separate power supply for each hard disk in order to avoid power failure (what sense does a redundant Host Drive make if all hard disks forming the Host Drive are operated with one single power supply and this power supply fails ?). All participants of a SCSI-bus must have a different SCSI-ID. In addition, both ends of the SCSI-cable must be equipped with SCSI-bus terminator resistors. The SCSI-bus termination is crucial, since it is highly probable that a wrongly terminated SCSI-bus will cause malfunctions of the connected devices and data transfer problems. The ICP Controller for this example has three independent SCSI channels: A, B, C. In our example, two SCSI hard disks are connected to channel A (DR1, DR2), one to channel B (DR3) and two to channel C (DR4, DR5). Our connection scheme is:

GDT-Channel A ——— DR1 ——— DR2
GDT-Channel B ——— DR3
GDT-Channel C ——— DR4 ——— DR5

We make sure that all three channels have a proper SCSI bus termination. The SCSI-IDs are set according to the following list:

GDT channel A ——— ID 7 (default)
DR1 ——— ID 0
DR2 ——— ID 6

GDT channel B ——— ID 7 (default)
DR3 ——— ID 2

GDT channel C ——— ID 7 (default)
DR4 ——— ID 2
DR5 ——— ID 4

Also three SCSI-cables are needed. The cables for channel A and C have three connectors, where the cable for channel B has four, of which two connectors are used by a hard disk and a CD-ROM drive which are not relevant for our example.
Please note: bad SCSI-cables, wrong SCSI-IDs as well as a wrong termination of the busses are responsible for 98% of all possible errors !
In addition, it is essential that the hard disks and the controller be connected to the SCSI-cable with the right orientation. Although SCSI-cables are keyed, you should cross-check if all connectors of the cable have been pressed matching the correct key, especially when using home-made cables.
We recommend terminating the SCSI-cables at their ends opposite to the controller by means of so-called external terminator packs. These packs receive their terminator power directly from the cable. In this case, the termination is to be removed from or disabled on all hard disks. In order to get the best signal quality on the cable, the external terminator packs should have an active SCSI termination. Advantage: If you use the termination of a hard disk and this hard disk happens to fail in a manner that harms the bus termination, then it may occur that all devices connected to this cable do not function properly. Therefore, it is sensible to use external terminators for reasons of redundancy.

C.8.2 Setting up a RAID 5 Disk Array

Step 1: Loading GDTSETUP

You can load GDTSETUP in two ways:

1. Press the <CTRL><G> key combination when the GDT BIOS message comes up (shortly after switching on the computer) and load GDTSETUP from the Flash-RAM of the ICP Controller. In this case no operating system is required.
   If GDTSETUP was loaded this way, there is an "R" (ROM) behind the version number.

2. Load GDTSETUP from disk under MS-DOS. Boot the MS-DOS-operating system (either from a boot-floppy or from an already existing boot drive, i.e., IDE-hard disk etc.). In order for GDTSETUP to work properly, you have to load the device driver GDTX000 first. This can be done in two ways:

   a.) Load GDTX000 from the DOS-command level by typing in GDTX000<ENTER>
   b.) Load GDTX000 automatically through the CONFIG.SYS file (DEVICE=GDTX000.EXE)

   Note: GDTSETUP.EXE as well as GDTX000.EXE are on the *System Disk* - DOS.
   If GDTSETUP was loaded this way, there is a "D" (Disk) behind the version number.

You may ask now, what are the differences between the two GDTSETUP variants ?
They are small. The GDTSETUP variant loadable from disk under MS-DOS also additionally allows the partitioning of Host Drives which is not possible with GDTSETUP loaded from the Flash-RAM. Loading GDTSETUP from the Flash-RAM is pretty comfortable, since there is nothing more required to configure the disk arrays. User's, who have for instance, an NT installation without a DOS partition, will highly appreciate this Flash-RAM-resident GDTSETUP.

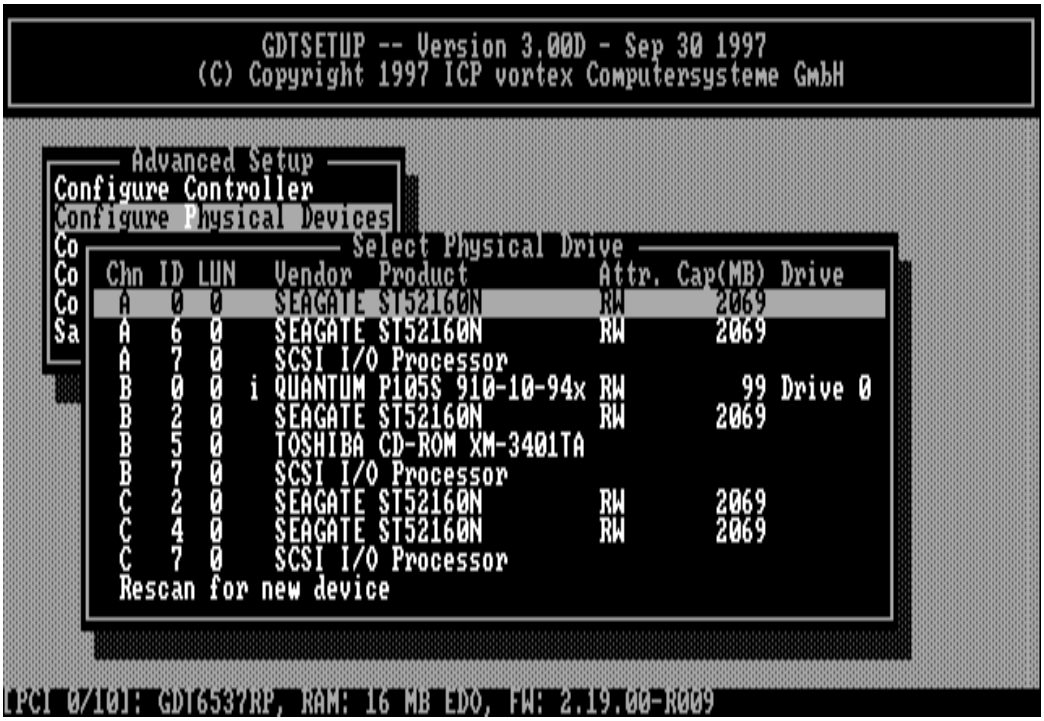
For our example, it is not relevant, whether we load GDTSETUP from the Flash-RAM, or from disk.

Now load GDTSETUP. The first menu asks you to select the desired ICP Controller. In our example there is only one ICP Controller installed in the system. Therefore simply press <ENTER> and then <F2> to select the Advanced Setup.

GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Configure Array Drives
Configure Host Drives
Save Information
F2: Express Setup
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

Step 2: Configure Physical Devices

Now activate the menu *Configure Physical Devices* (level 1). A list appears showing all hard disks found on the ICP Controller's SCSI channels. If you have a ICP Controller with a different number of SCSI channels, the existing SCSI channels are displayed. Note: This screen will always report all devices that are found to be connected to SCSI-cables, even though GDTSETUP only allows you to work on *Direct Access Devices* (and therefore not on tape drives, DATs, CD ROMs etc.).


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Select Physical Drive
Chn ID LUN Vendor Product Attr. Cap(MB) Drive
A 0 0 SEAGATE ST52160N RW 2069
A 6 0 SEAGATE ST52160N RW 2069
A 7 0 SCSI I/O Processor
B 0 0 i QUANTUM P105S 910-10-94x RW 99 Drive 0
B 2 0 SEAGATE ST52160N RW 2069
B 5 0 TOSHIBA CD-ROM XM-3401TA
B 7 0 SCSI I/O Processor
C 2 0 SEAGATE ST52160N RW 2069
C 4 0 SEAGATE ST52160N RW 2069
C 7 0 SCSI I/O Processor
Rescan for new device
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

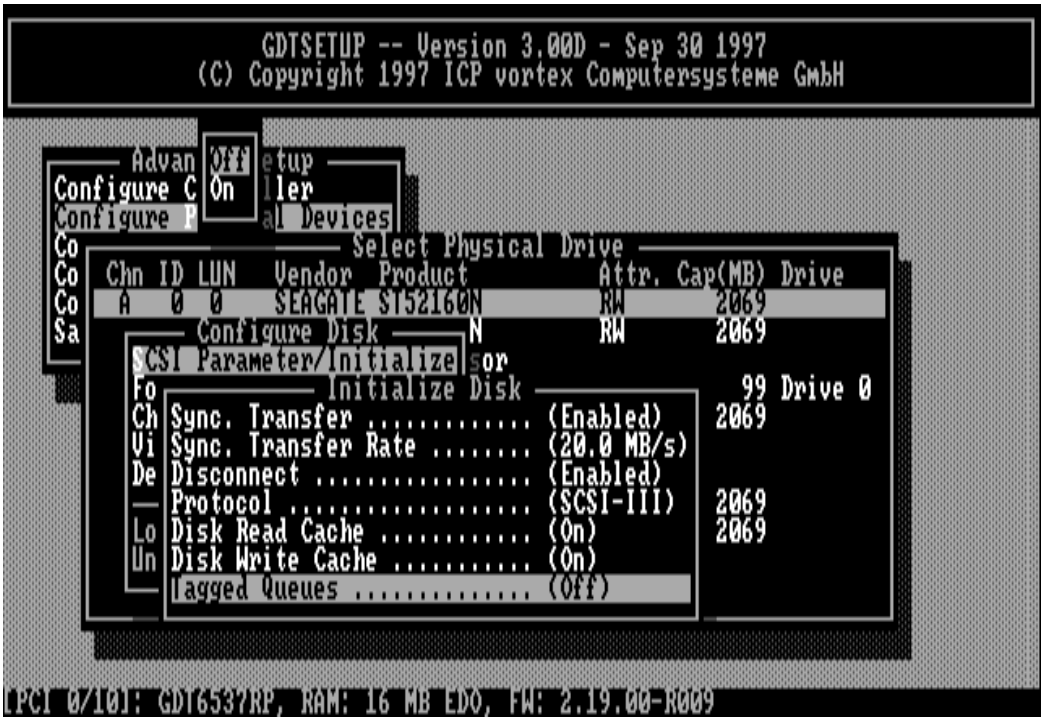
The screen shows you:

- the channel to which a SCSI device is connected
- which SCSI-ID the drive has (the entry SCSI I/O Processor stands for the corresponding SCSI channel of the ICP Controller. It has the default setting ID 7, as explained in chapter B)
- the initialization state
- the SCSI names of the drives
- the Read-Write-state. [RW] = Read + Write
- the gross capacity
- membership in a Logical, Array or Host Drive

Use the cursor keys ↑ and ↓ to select the drive you wish to initialize. We start with the first drive of the list. With this drive selected, press <ENTER>.

(Note: On Channel B, SCSI IDs 0 and 5, are devices which are not relevant for our example.)

The *Configure Disk* menu appears which shows various options.
For our example we choose the *Initialize Disk* menu option and press <ENTER>.
The parameters within this menu can be changed by pressing <ENTER> and selecting the new setting.


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Select Physical Drive
Chn ID LUN Vendor Product Attr. Cap(MB) Drive
A 0 0 SEAGATE ST52160N RW 2069
Configure Disk
SCSI Parameter/Initialize
Initialize Disk
Sync. Transfer ..... (Enabled)
Sync. Transfer Rate ..... (20.0 MB/s)
Disconnect ..... (Enabled)
Protocol ..... (SCSI-III)
Disk Read Cache ..... (On)
Disk Write Cache ..... (On)
Tagged Queues ..... (Off)
99 Drive 0
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

1. *Sync. Transfer*: *Enable*
The SCSI-bus allows an asynchronous and a synchronous transfer. Every SCSI device must be able to perform the first type of transfer, the second one is optional. The advantage of the synchronous transfer lies in a higher data transfer rate as the signal transfer times on the possibly long SCSI-cable have no influence on the transfer rate anymore. Two SCSI-bus participants wanting to exchange data between each other have to check if and how (i.e., with which parameters) a synchronous data transfer between them is possible. Therefore, the mere setting does not automatically enable synchronous data transfer; this mode is only effective if both devices support it and after they have checked their capability of communicating with each other in this mode.

2. *Sync. Transfer Rate*
The maximum synchronous transfer rate can be limited. This limitation may become necessary if a particular SCSI cabling does not allow the maximum rate the drive and the controller could achieve. In our example, we leave the rate at 20.0 MB/s (for Wide SCSI at 20.0 MB/s, Wide/Ultra SCSI at 40.0 MB/s and Wide/Ultra2 SCSI at 80.0 MB/s).
Note: In order to select a transfer rate above 10.0 MB/s the Protocol has to be set to SCSI-III.

3. *Disconnect*: *Enable*
The concept of the SCSI-bus allows several participants. All these participants should be able to use the bus in a manner that causes the least reciprocal disturbance or obstruction. A participant should therefore vacate the bus if he does not need it. For reasons of performance, it is particularly important to guarantee a high degree of overlapping of the actions on the SCSI-bus. This high degree of overlapping can be achieved if a SCSI device is allowed to disconnect, thus leaving the bus to be used by other participants. If there is only one SCSI device connected to the SCSI-bus, Disconnect should be disabled.

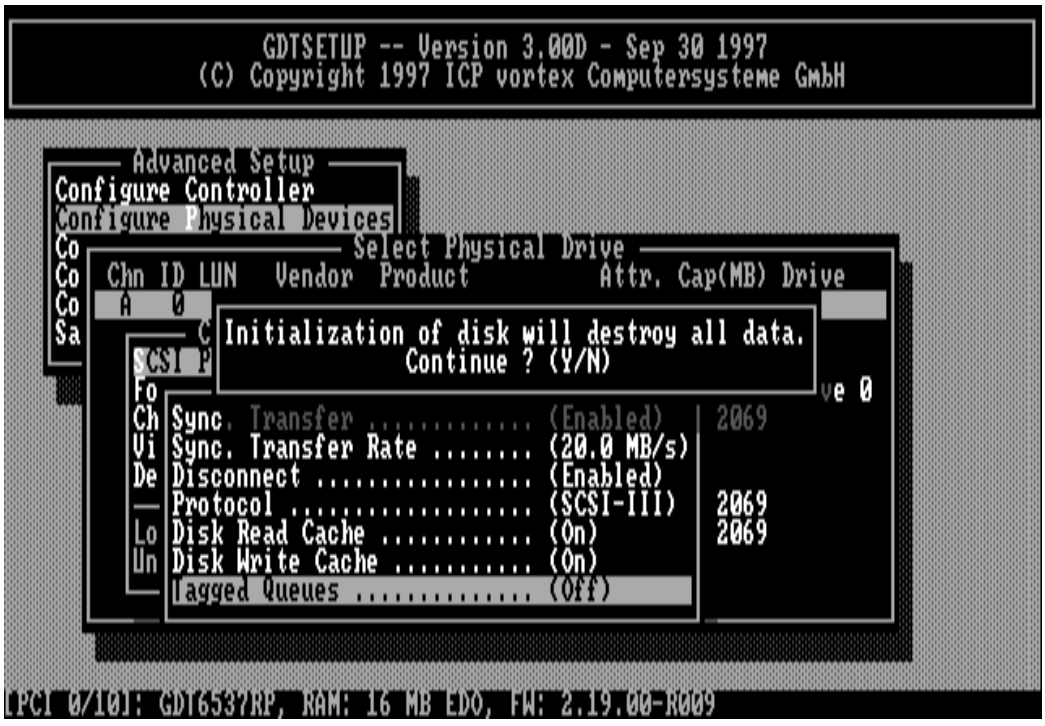
4. *Protocol*
This can be either SCSI-II or SCSI-III.
If you select SCSI-III make sure, that your hard disk supports this protocol. Most new multi-GB hard disks support SCSI-III. To enable Ultra (FAST-20) and Ultra2 (FAST-40) transfer rates (Wide/Ultra: 40 MB/s: Wide/Ultra2: 80 MB/s), SCSI-III protocol is required.

5. *Disk Read Cache / Disk Write Cache / Tagged Queues*
If a drive supports particular SCSI features you enable them (On).
Note: Most of the modern drives support disk caching (read and write). Some do not support Tagged Queues.

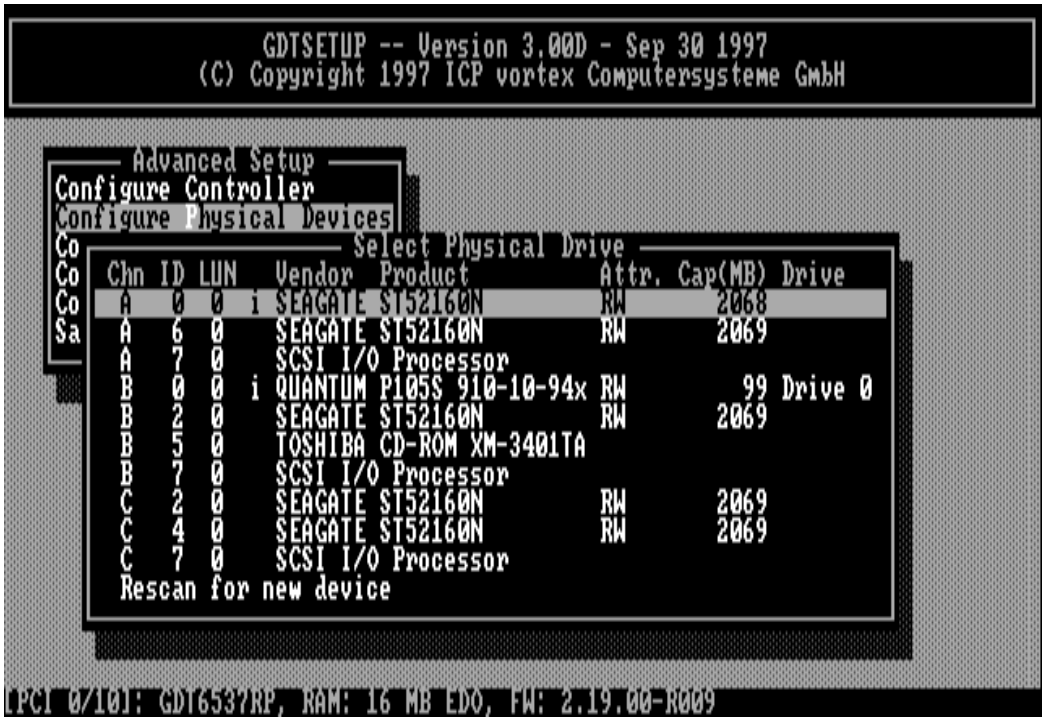
Press <ESC> to leave the *Initialize Disk* menu.
GDTSETUP displays a warning on the destruction of all data. This implies two different evaluations, according to the drive's current state and the options you have selected:

1. *First Initialization of the* SCSI *Device.*
   In this case the warning must be taken seriously. If the drive was previously connected to a different controller (e.g., NCR etc.) and still contains data, this data will be lost now.

2. *The* SCSI *Device was already initialized.*
   If only internal parameters, such as Disconnect, Synchronous Transfer and SCSI-II options have been changed, the data on the drive remains intact. Only the function state of the device is changed.


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Select Physical Drive
Chn ID LUN Vendor Product Attr. Cap(MB) Drive
A 0
Initialization of disk will destroy all data.
Continue ? (Y/N)
Sync. Transfer ..... (Enabled) 2069
Sync. Transfer Rate ..... (20.0 MB/s)
Disconnect ..... (Enabled)
Protocol ..... (SCSI-III) 2069
Disk Read Cache ..... (On) 2069
Disk Write Cache ..... (On)
Tagged Queues ..... (Off)
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

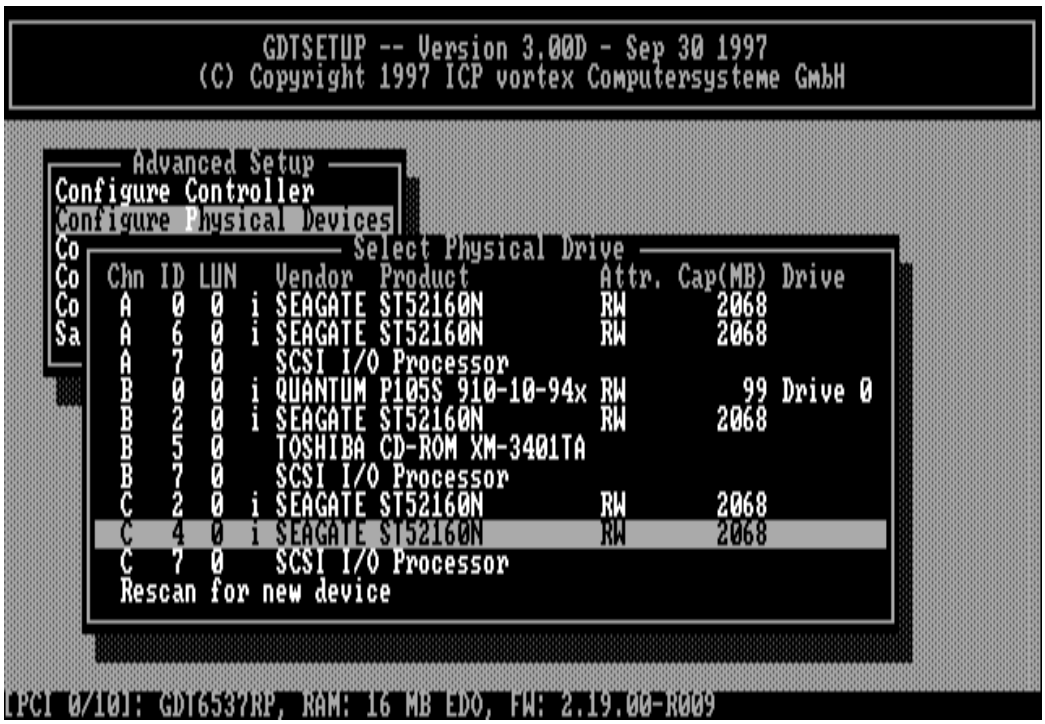
Press <Y> and we are back on the main screen of level 1 and see that the initialization-state of the SCSI device has changed.


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Select Physical Drive
Chn ID LUN Vendor Product Attr. Cap(MB) Drive
A 0 0 i SEAGATE ST52160N RW 2068
A 6 0 SEAGATE ST52160N RW 2069
A 7 0 SCSI I/O Processor
B 0 0 i QUANTUM P105S 910-10-94x RW 99 Drive 0
B 2 0 SEAGATE ST52160N RW 2069
B 5 0 TOSHIBA CD-ROM XM-3401TA
B 7 0 SCSI I/O Processor
C 2 0 SEAGATE ST52160N RW 2069
C 4 0 SEAGATE ST52160N RW 2069
C 7 0 SCSI I/O Processor
Rescan for new device
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

Initialize the remaining four SEAGATE drives as described above, that is:

- Select the device with the cursor keys ↑ and ↓ and press the <ENTER>-key
- Choose the settings shown above
- Carry out the initialization

When the initialization of the last SCSI device has been completed, the screen should look as follows (a small **i** (i = initialized) must follow the SCSI-ID of each SCSI device):


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Select Physical Drive
Chn ID LUN Vendor Product Attr. Cap(MB) Drive
A 0 0 i SEAGATE ST52160N RW 2068
A 6 0 i SEAGATE ST52160N RW 2068
A 7 0 SCSI I/O Processor
B 0 0 i QUANTUM P105S 910-10-94x RW 99 Drive 0
B 2 0 i SEAGATE ST52160N RW 2068
B 5 0 TOSHIBA CD-ROM XM-3401TA
B 7 0 SCSI I/O Processor
C 2 0 i SEAGATE ST52160N RW 2068
C 4 0 i SEAGATE ST52160N RW 2068
C 7 0 SCSI I/O Processor
Rescan for new device
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

Important: Moving to the next level (Configure Logical Drives) only makes sense if all SCSI devices you need there are initialized.

Step 3: Configure Logical Drives

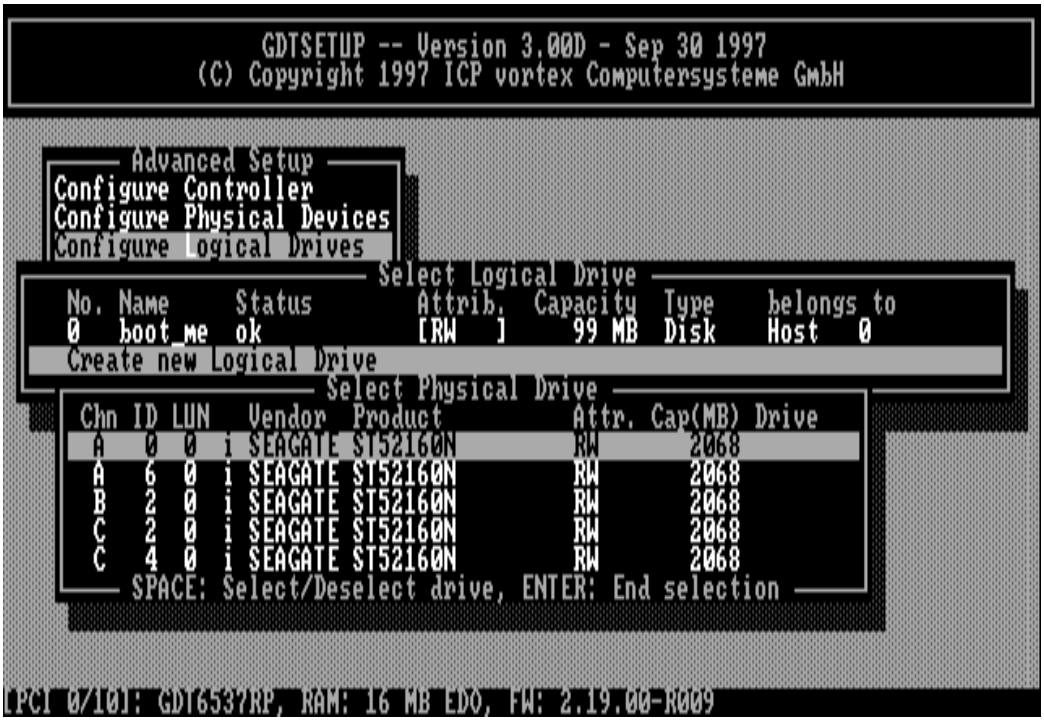
We now leave level 1 (by pressing the <ESC>-key) and are back in the main menu. Now, with the cursor keys ↑ and ↓ select *Configure Logical Drives* and go to level 2 by pressing <ENTER>.

GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Configure Array Drives
Configure Host Drives
Save Information
F2: Express Setup
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

The main screen of level 2 appears. Move the selection bar to C*reate new Logical Drives* and press <ENTER> .

GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Select Logical Drive
No. Name Status Attrib. Capacity Type belongs to
0 boot_me ok [RW] 99 MB Disk Host 0
Create new Logical Drive
F2: Drive Information, F3: Load All, F10: Refresh
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

Note: The already existing Logical Drive in this list has no relevance for our example.

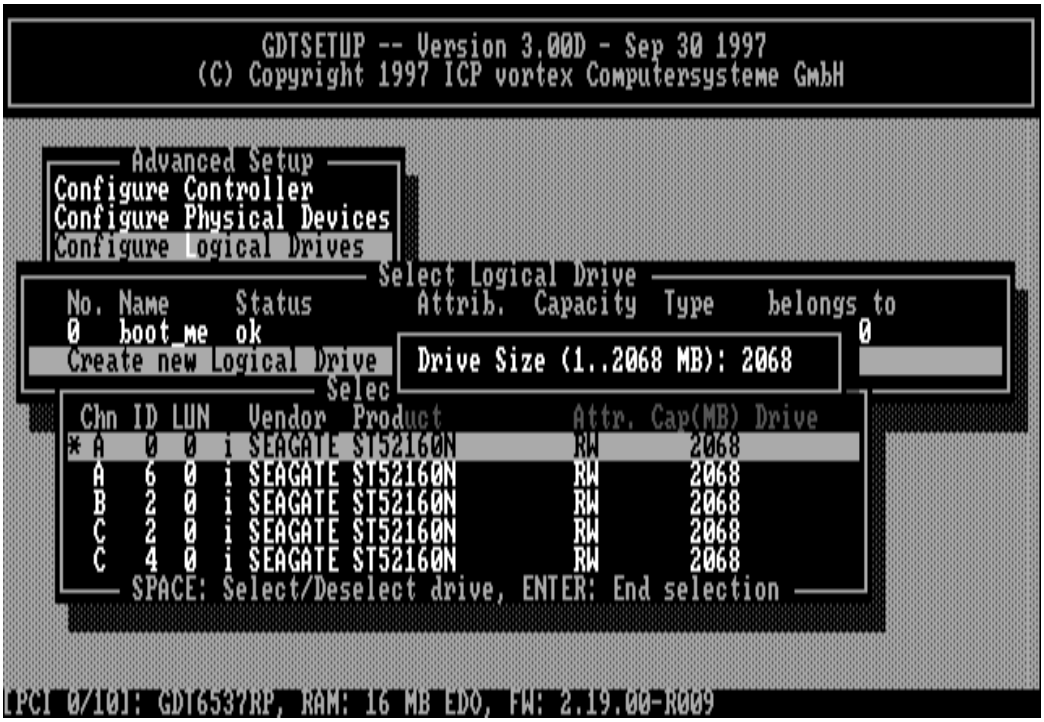

GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Select Logical Drive
No. Name Status Attrib. Capacity Type belongs to
0 boot_me ok [RW] 99 MB Disk Host 0
Create new Logical Drive
Select Physical Drive
Chn ID LUN Vendor Product Attr. Cap(MB) Drive
A 0 0 i SEAGATE ST52160N RW 2068
A 6 0 i SEAGATE ST52160N RW 2068
B 2 0 i SEAGATE ST52160N RW 2068
C 2 0 i SEAGATE ST52160N RW 2068
C 4 0 i SEAGATE ST52160N RW 2068
SPACE: Select/Deselect drive, ENTER: End selection
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

Select the initialized hard disk with the <SPACE>-bar (it becomes marked with an "*") and press <ENTER>.

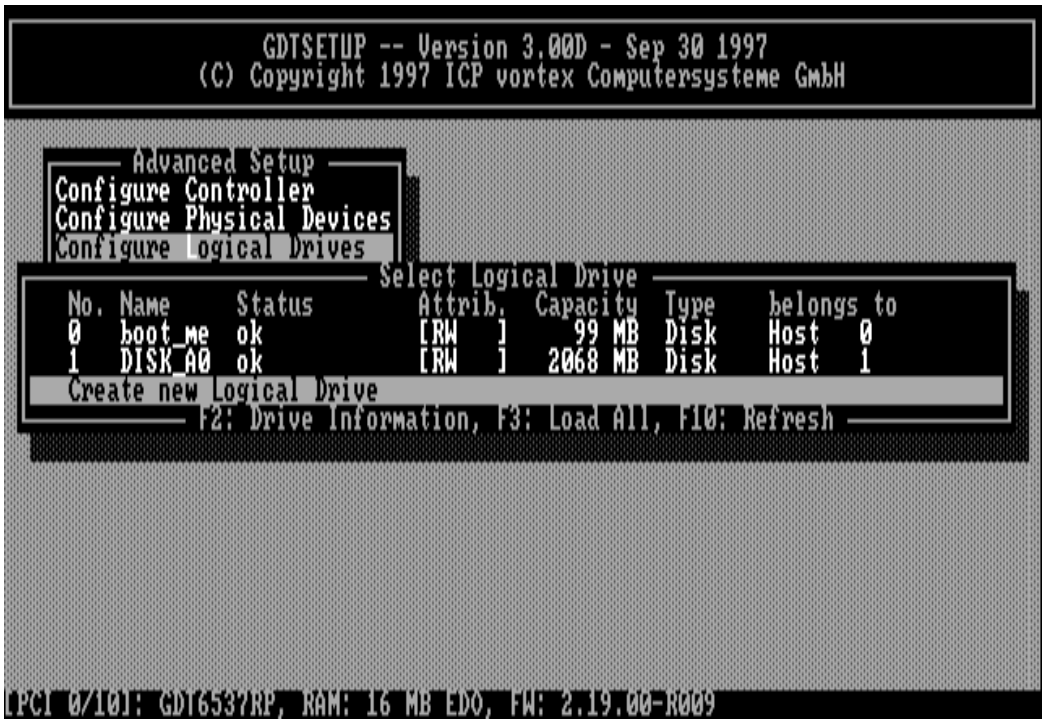
GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Select Logical Drive
Do you want to create a SINGLE drive from the selected disk(s) ?
(CAUTION: All data will be destroyed !) (Y/N)
Chn ID LUN Vendor Product Attr. Cap(MB) Drive
* A 0 0 i SEAGATE ST52160N RW 2068
A 6 0 i SEAGATE ST52160N RW 2068
B 2 0 i SEAGATE ST52160N RW 2068
C 2 0 i SEAGATE ST52160N RW 2068
C 4 0 i SEAGATE ST52160N RW 2068
SPACE: Select/Deselect drive, ENTER: End selection
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

For security reasons, you will be asked again if you want to use the selected disk to create a Logical Drive. As we are sure of our choice, we confirm with <Yes>. GDTSETUP allows you to limit the hard disk size for this Logical Drive. This becomes interesting when you configure disk arrays and you want to make sure that future drives you want to bring into the disk array (e.g., for the capacity expansion or for replacement purposes) fit. It would be bad luck if the new drive only had 2067 MB. GDTSETUP couldn't accept it. To avoid this occuring, you could limit the capacity of each drive to 2000 MB. Any new 2 GB drive must have at

least this capacity. The 68 MB in our example would be lost. For this example we use the full capacity and press <ENTER> .

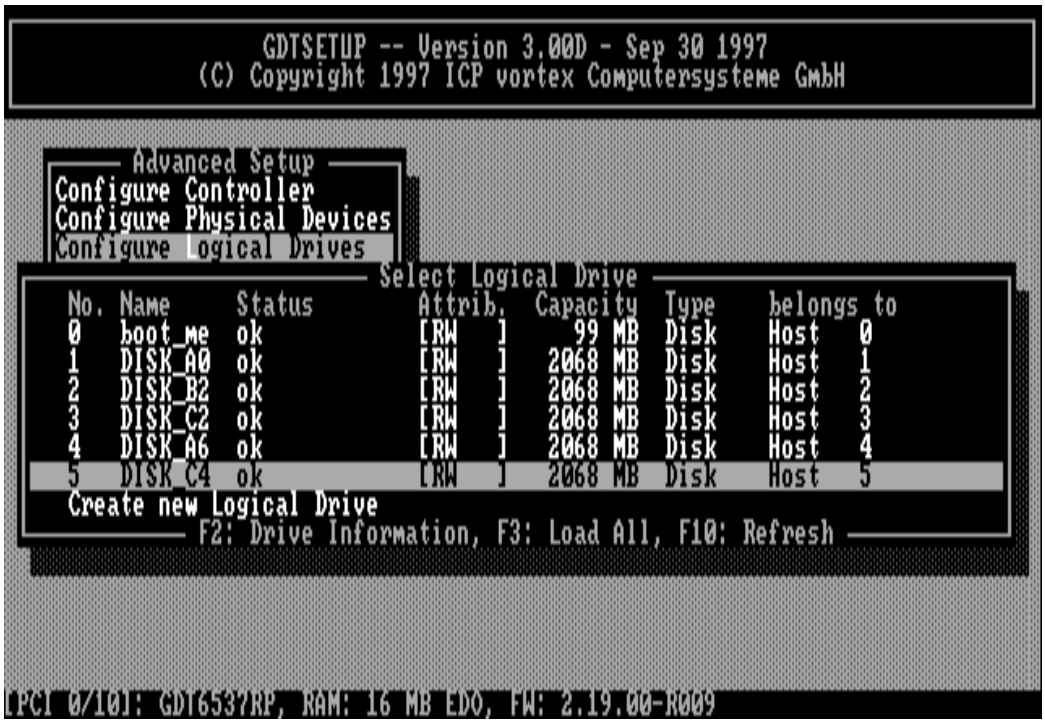

GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Select Logical Drive
No. Name Status Attrib. Capacity Type belongs to
0 boot_me ok 0
Create new Logical Drive
Drive Size (1..2068 MB): 2068
Chn ID LUN Vendor Product Attr. Cap(MB) Drive
A 0 0 i SEAGATE ST52160N RW 2068
A 6 0 i SEAGATE ST52160N RW 2068
B 2 0 i SEAGATE ST52160N RW 2068
C 2 0 i SEAGATE ST52160N RW 2068
C 4 0 i SEAGATE ST52160N RW 2068
SPACE: Select/Deselect drive, ENTER: End selection
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

The dialog box is closed and we are back in the main menu of level 2.


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Select Logical Drive
No. Name Status Attrib. Capacity Type belongs to
0 boot_me ok [RW] 99 MB Disk Host 0
1 DISK_A0 ok [RW] 2068 MB Disk Host 1
Create new Logical Drive
F2: Drive Information, F3: Load All, F10: Refresh
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

As you can see, we have already created a new Logical Drive of the type D*isk*. The name of the Logical Drive is assigned automatically and contains the channel description and the SCSI-ID after the "_" . This can serve as a reminder when you install a complex system with many drives. (Naturally, you may change the name.). Now configure the remaining Logical Drives one by one. Pay attention to choose the SCSI devices alternately from the SCSI channels. This selection method has a considerable impact on the disk array's performance because the data is written to the Logical Drives in stripes. If the consecutive Logical Drive

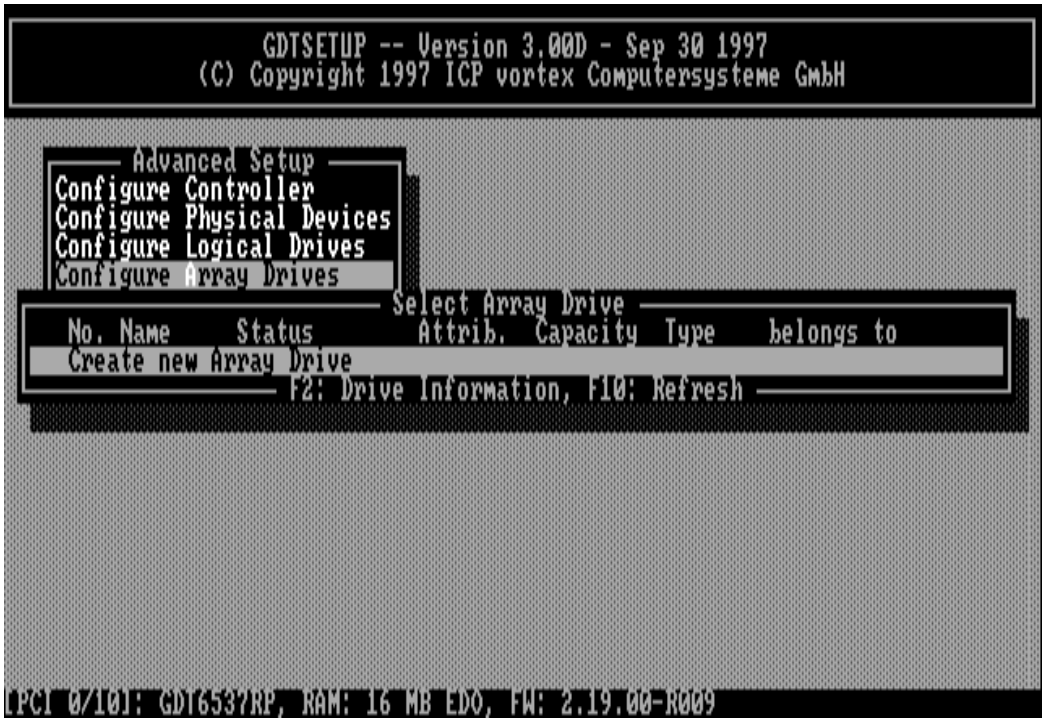
is controlled by another SCSI channel, independent Logical Drive accesses become possible, resulting in a high degree of overlapping. After having completed these procedures for all five Logical Drives, you will see the following screen:


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Select Logical Drive
No. Name Status Attrib. Capacity Type belongs to
0 boot_me ok [RW] 99 MB Disk Host 0
1 DISK_A0 ok [RW] 2068 MB Disk Host 1
2 DISK_B2 ok [RW] 2068 MB Disk Host 2
3 DISK_C2 ok [RW] 2068 MB Disk Host 3
4 DISK_A6 ok [RW] 2068 MB Disk Host 4
5 DISK_C4 ok [RW] 2068 MB Disk Host 5
Create new Logical Drive
F2: Drive Information, F3: Load All, F10: Refresh
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

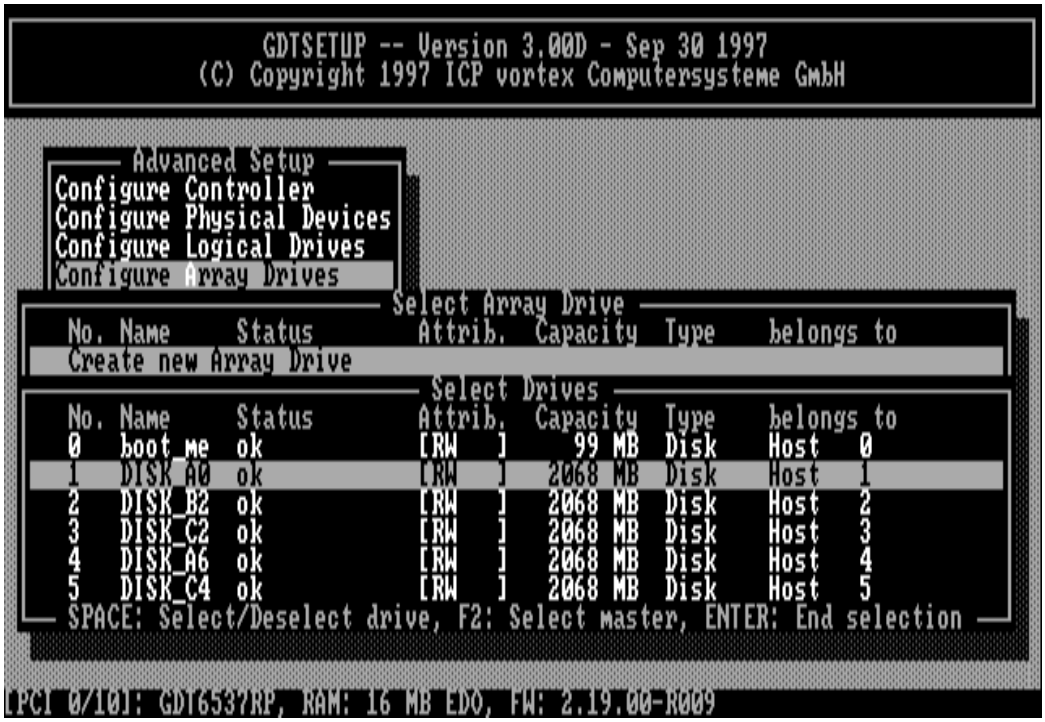
This concludes the installation on level 2. Now press the <ESC>-key to leave this screen.

Step 4: Configure Array Drives

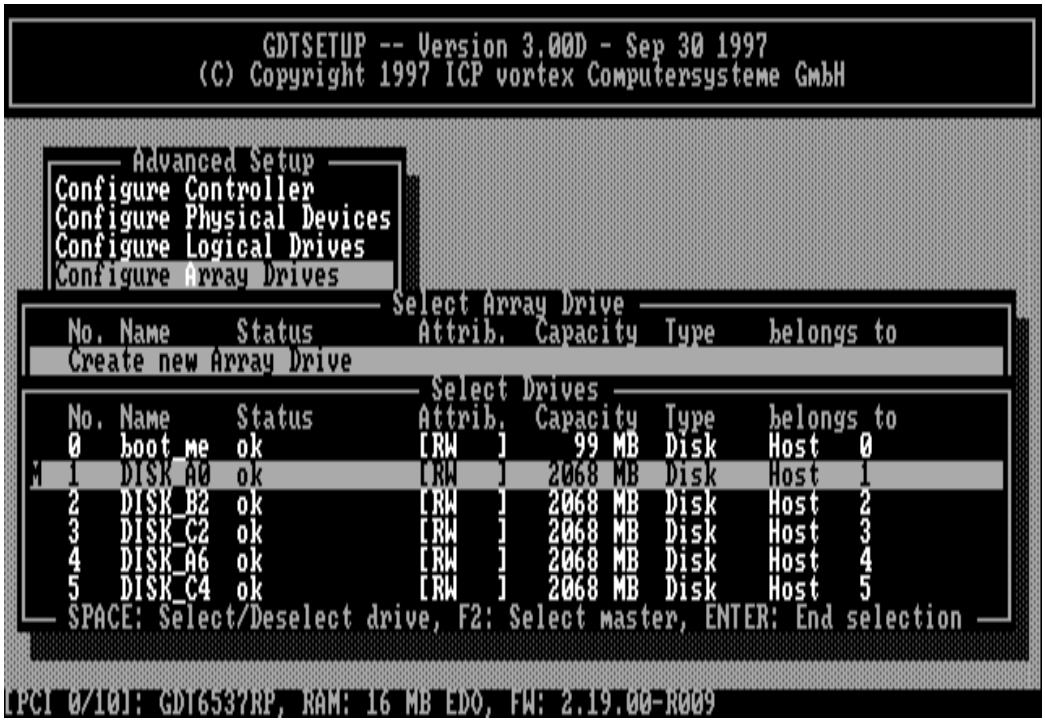
We now leave level 2 (by pressing the <ESC>-key) and are back in the main menu. Now, with the cursor keys ↑ and ↓ select *Configure Array Drives* and go to level 3 by pressing <ENTER>.


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Configure Array Drives
Select Array Drive
No. Name Status Attrib. Capacity Type belongs to
Create new Array Drive
F2: Drive Information, F10: Refresh
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

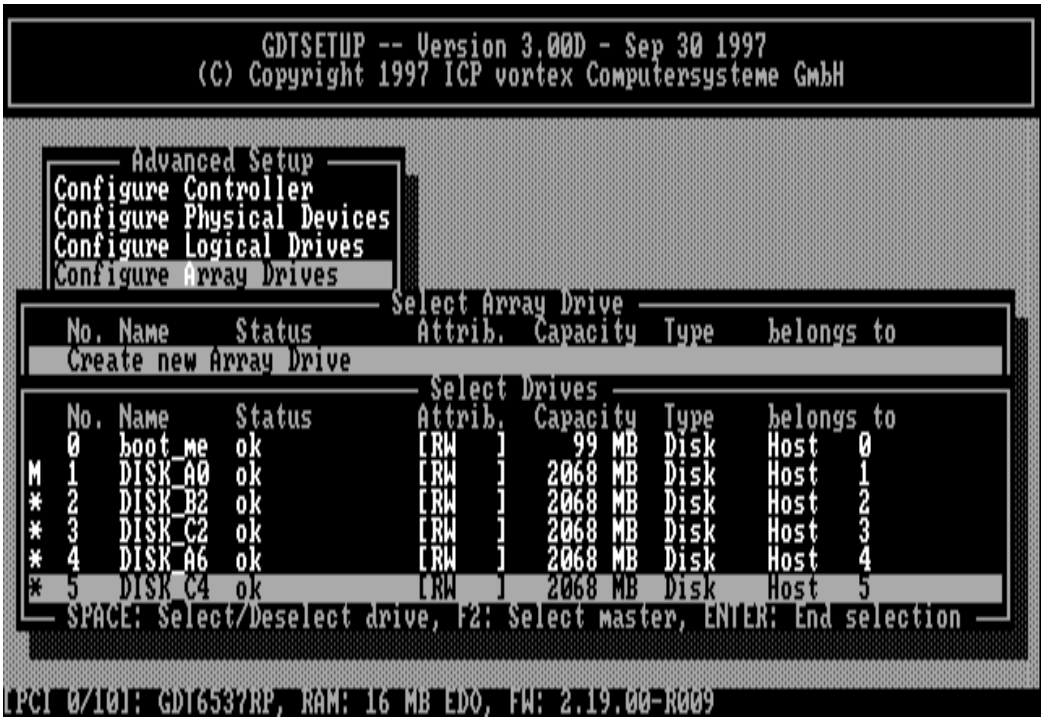
Since we want to create a new Array Drive press <ENTER>.
Note: The first entry in this list has no relevance for our example.


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Configure Array Drives
Select Array Drive
No. Name Status Attrib. Capacity Type belongs to
Create new Array Drive
Select Drives
No. Name Status Attrib. Capacity Type belongs to
0 boot_me ok [RW] 99 MB Disk Host 0
1 DISK_A0 ok [RW] 2068 MB Disk Host 1
2 DISK_B2 ok [RW] 2068 MB Disk Host 2
3 DISK_C2 ok [RW] 2068 MB Disk Host 3
4 DISK_A6 ok [RW] 2068 MB Disk Host 4
5 DISK_C4 ok [RW] 2068 MB Disk Host 5
SPACE: Select/Deselect drive, F2: Select master, ENTER: End selection
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

Move the selection bar to the second entry and press the <SPACE>-bar. The entry is marked with an "M" for Master. This means that the disk array "begins" with this Logical Drive.

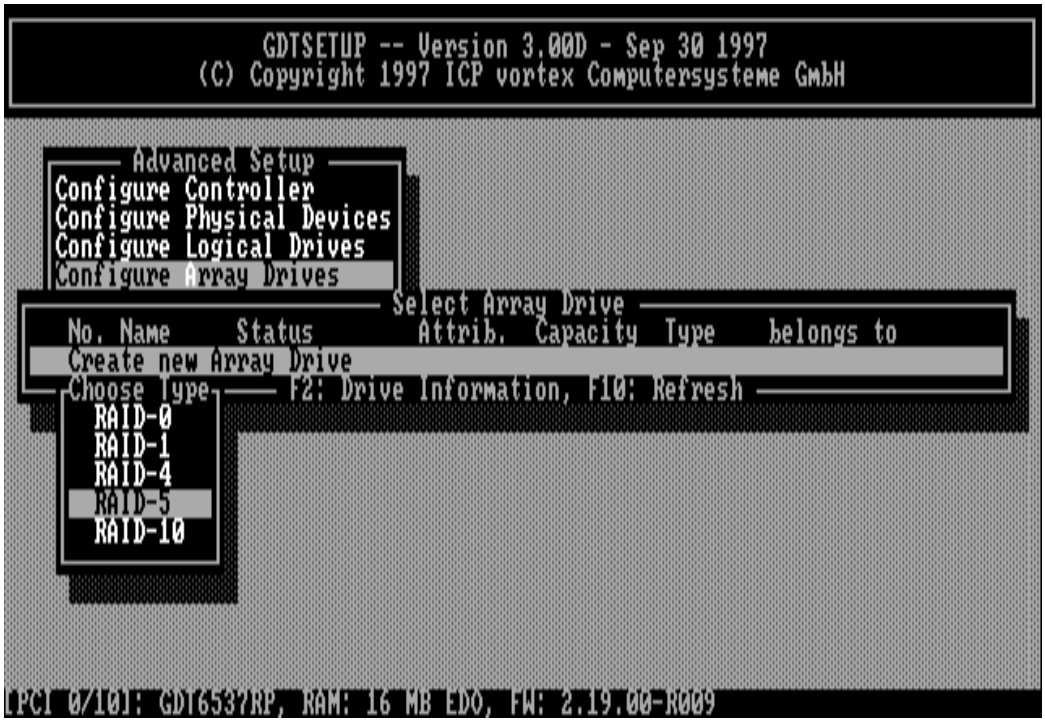

GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Configure Array Drives
Select Array Drive
No. Name Status Attrib. Capacity Type belongs to
Create new Array Drive
Select Drives
No. Name Status Attrib. Capacity Type belongs to
0 boot_me ok [RW] 99 MB Disk Host 0
M 1 DISK_A0 ok [RW] 2068 MB Disk Host 1
2 DISK_B2 ok [RW] 2068 MB Disk Host 2
3 DISK_C2 ok [RW] 2068 MB Disk Host 3
4 DISK_A6 ok [RW] 2068 MB Disk Host 4
5 DISK_C4 ok [RW] 2068 MB Disk Host 5
SPACE: Select/Deselect drive, F2: Select master, ENTER: End selection
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

Move the selection bar with the cursor key ↓ to the next entry and press the <SPACE>-bar, again. It is marked with an "*"(pressing the <SPACE>-bar again undoes your choice). Repeat this selection until all five Logical Drives are marked.

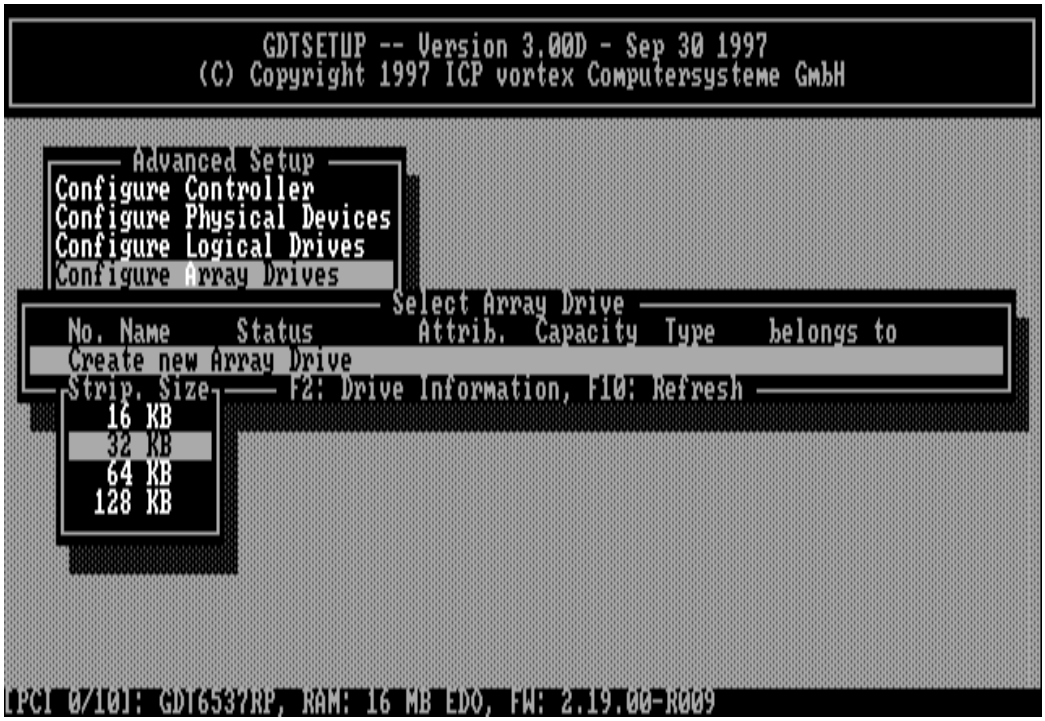

GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Configure Array Drives
Select Array Drive
No. Name Status Attrib. Capacity Type belongs to
Create new Array Drive
Select Drives
No. Name Status Attrib. Capacity Type belongs to
0 boot_me ok [RW] 99 MB Disk Host 0
M 1 DISK_A0 ok [RW] 2068 MB Disk Host 1
* 2 DISK_B2 ok [RW] 2068 MB Disk Host 2
* 3 DISK_C2 ok [RW] 2068 MB Disk Host 3
* 4 DISK_A6 ok [RW] 2068 MB Disk Host 4
* 5 DISK_C4 ok [RW] 2068 MB Disk Host 5
SPACE: Select/Deselect drive, F2: Select master, ENTER: End selection
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

When the last Logical Drive is selected, confirm with <ENTER>. GDTSETUP now displays a list of possible RAID levels available with the number of Logical Drives selected.

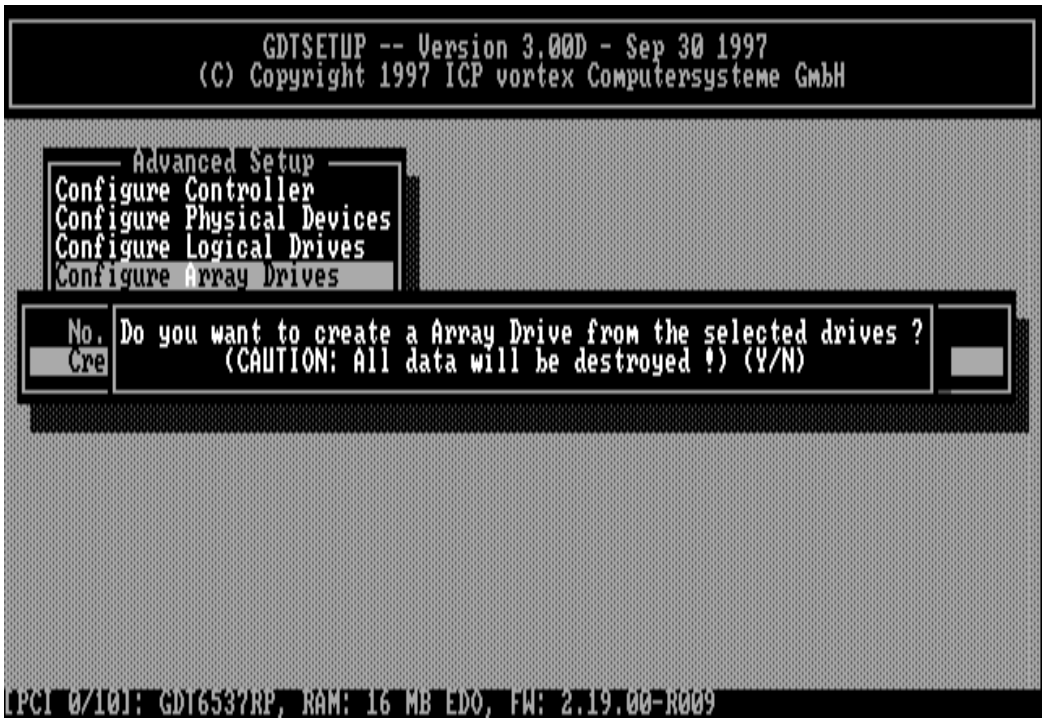
- RAID 0 pure data striping without redundancy
- RAID 1 disk mirroring
- RAID 4 data striping with dedicated parity drive
- RAID 5 data striping with striped parity
- RAID 10 RAID 0 combined with RAID 1



In our case we take RAID-5 and press <ENTER>.

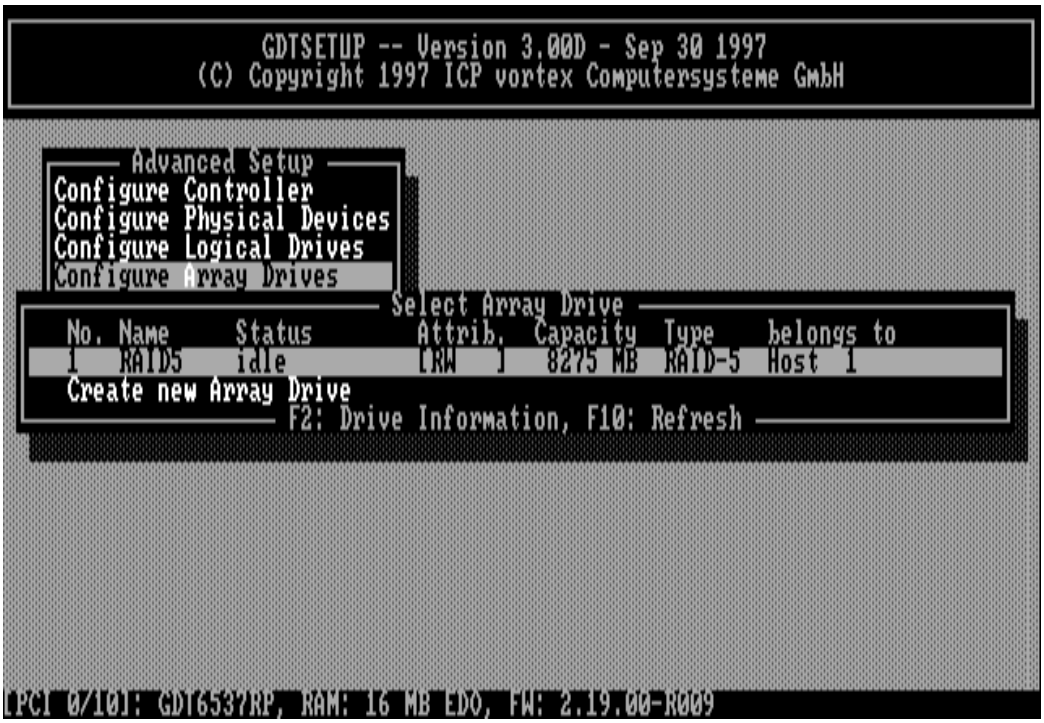


GDTSETUP asks for the *Stripe Size*. This is the size of the stripes into which the data is divided. The default is 32KB which we leave for this example and therefore press <ENTER>. (Note: 32KB stripe size is suggested because in various performance tests it has proved to be the best value.). GDTSETUP displays a security request, which we confirm with <Y>.


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Configure Array Drives
No.
Cre
Do you want to create a Array Drive from the selected drives ?
(CAUTION: All data will be destroyed !) (Y/N)
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

GDTSETUP allows you to limit the capacity of the disk array. This may be of interest if your installation requires an exact size for a disk array. Normally, the full capacity is used. In our example we press <ENTER> .

GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Configure Array Drives
Select Array Drive
No. Name Status
Create new Array Drive
F2: Driv
Drive Size (1..8275 MB): 8275
s to
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Configure Array Drives
Select Array Drive
No. Name Status Attrib. Capacity Type belongs to
1 RAID5 idle [RW] 8275 MB RAID-5 Host 1
Create new Array Drive
F2: Drive Information, F10: Refresh
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

It's done !
We succeeded in setting up a RAID 5 disk array. The screen shows that the disk array is currently in an *idle* state. Later in this chapter, we shall explain the different states a RAIDYNE disk array can assume.
We are now back in the main menu of GDTSETUP.

Step 5: Configure Host Drives

We are now back in the main menu of GDTSETUP and select *Configure Host Drives*.
The main screen of level 4 appears. Press <ENTER> . A list of available Host Drives is displayed. Again, the first entry is not relevant for our example.

At position 1 we find our previously configured RAID-5 disk array. It was automatically transformed into a Host Drive, thus for this example we have nothing to do in this menu.

GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Configure Array Drives
Configure Host Drives
Select Host Drive
No. Name Status Attrib. Capacity Type belongs to
0 DISK_A0 ok [RW] 99 MB Disk Logical 0
1 RAID5 idle [RW] 8275 MB RAID-5 Array 1
Create new Host Drive
F2: Drive Information, F10: Refresh
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

Press <ENTER> to get a list of possible menu options.

GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Host Drive
Change Drive Name
Swap Host Drives
Remove Host Drive
Split Host Drive
Merge Host Drives
Partition Drive
Overwr. Master Boot Code
Select Host Drive
Attrib. Capacity Type belongs to
[RW] 99 MB Disk Logical 0
[RW] 8275 MB RAID-5 Array 1
F2: Drive Information, F10: Refresh
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

We should not forget to mention that if you would have selected *Create new Host Drive*, this would have lead you to exactly the same menu as the Express Setup mode.
But this example is an exercise which should help you to gain a better understanding of how the ICP Controller and GDTSETUP work.

By the way, if you have loaded GDTSETUP from the Flash-RAM (<CTRL><G>) the P*artition* D*rive* option will be missing in this menu. The reason is that partitioning makes no sense, when there is no operating system loaded and the INT13H extension of the ICP Controller has not yet been activated.

Step 6: Leaving GDTSETUP

We are now back in the main menu of GDTSETUP. The installation is completed, and we therefore leave GDTSETUP by pressing the <ESC>-key. The following message appears:

GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Configuration of drive(s) was modified.
System will be rebooted.
Press any key to reboot !

As we are done with the installation and therefore definitely want to leave GDTSETUP, we press any key.

IMPORTANT: Always end GDTSETUP by leaving the program in the regular way (do not warm-boot with CTRL-ALT-DEL or cold boot by pressing the RESET button). Certain information is only transferred to the controller when you leave GDTSETUP in the regular way.

After rebooting the system, load GDTSETUP anew. Change to the Advanced Setup menu, select C*onfigure* A*rray* D*rives*, and press <ENTER> . As you can see, the disk arrays Status has changed to build, i.e., the parity information is currently generated and written to the disks (you may already have noticed the disk activity).

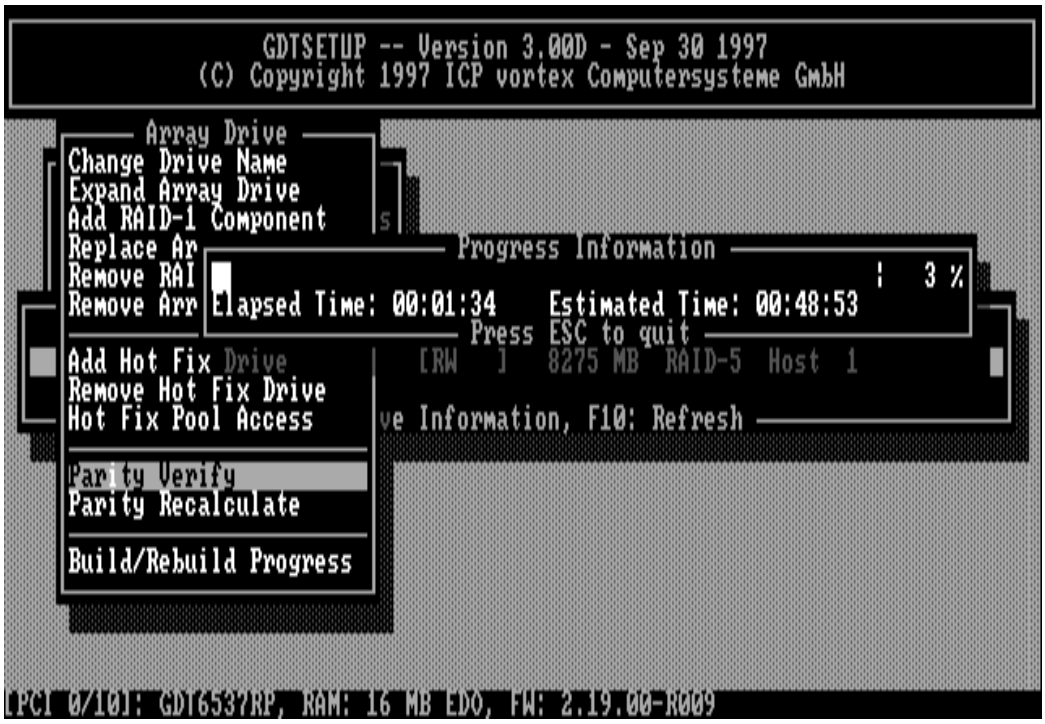
GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Configure Array Drives
Select Array Drive
No. Name Status Attrib. Capacity Type belongs to
1 RAID5 build [RW] 8275 MB RAID-5 Host 1
Create new Array Drive
F2: Drive Information, F10: Refresh
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

Press <ENTER> and move the selection bar to the B*uild/Rebuild Progress* menu. Press <ENTER> .

From the progress information slider, we can easily see, that the 8 GB disk array is already built up 11% and that the estimated time for the build process is 31 minutes.
Note: During the build process the disk array is fully operational, but not yet redundant. I.e., you could immediately start installing your desired operating system, without having to wait until this process has finished.
At the end of this build process the disk arrays state becomes ready (fully redundant).

GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Configure Array Drives
Select Array Drive
No. Name Status Attrib. Capacity Type belongs to
1 RAID5 ready [RW] 8275 MB RAID-5 Host 1
Create new Array Drive
F2: Drive Information, F10: Refresh
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

Now press <ENTER> and move the selection bar to the P*arity Verify* menu. Press <ENTER>.



RAIDYNE now checks the correctness of the redundancy information (i.e., calculates the redundancy information anew and compares it with the already existing information).

Depending on how large the disk array is, this check may take quite a long time, however, it can be aborted by pressing <ESC>. P*arity Verify* is a diagnosis function which enables you to verify the consistency of a disk array every now and then. We interrupt the verification by pressing <ESC>. Note: The GDT monitor program **GDTMON** also includes the parity verify function. Unlike in GDTSETUP, the disk array's parity can be checked while the disk array is

fully operational (e.g., in a NetWare file server). Further information on GDTMON is given in a separate chapter of this manual.

Step 7: Simulating a Drive Failure

This part of our example is optional. Nevertheless, we recommend that you go through it. It gives you a better understanding of how RAIDYNE reacts in the event of a drive failure and what you have to do in such a case.

Important: To carry out the drive failure simulation, the disk array must be in the *ready* state. Only in this state, has the disk array redundancy.

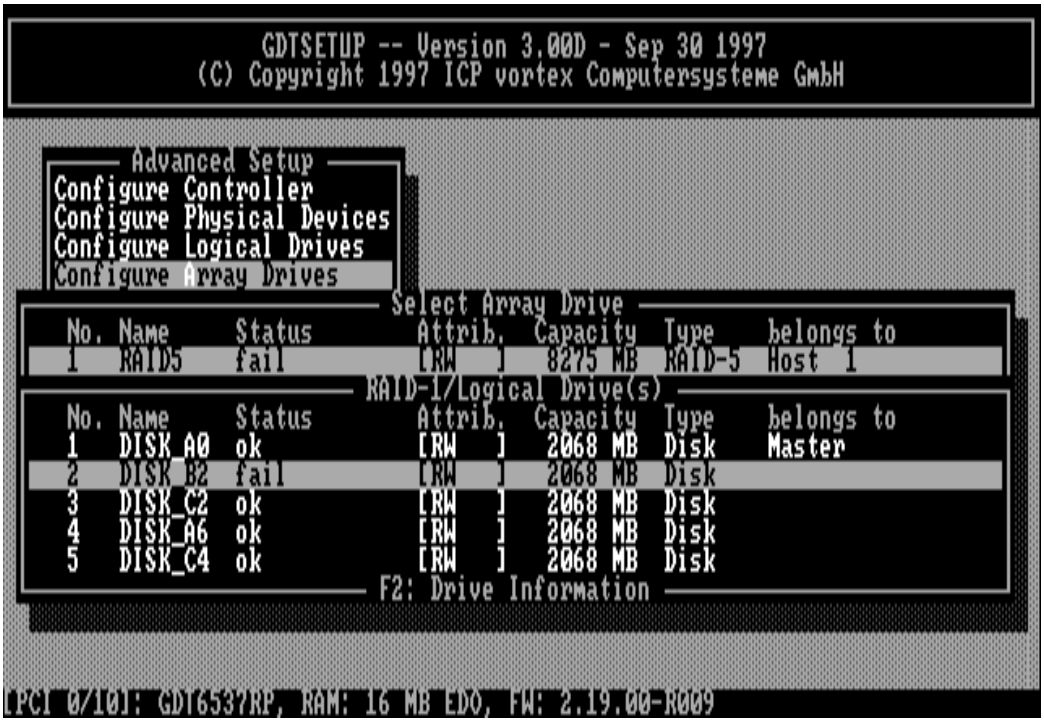
In order to make the simulation as realistic as possible, we suggest creating an MS-DOS-partition on the disk array with FDISK. To create disk activity, write a small batch program which copies data from one directory of this partition to another. While the copy process is going on, we simulate a drive failure of drive DISK_B2 by removing the drive's DC power supply cable. (If you choose to let another drive fail, please keep in mind the information on the SCSI-bus termination given in S*tep* 1). Now we can observe how RAIDYNE reacts:

1. After a short time, the acoustical alarm of the GDT is activated. (Note: this alarm is only activated when the RAID 5 Array Drive is being accessed).

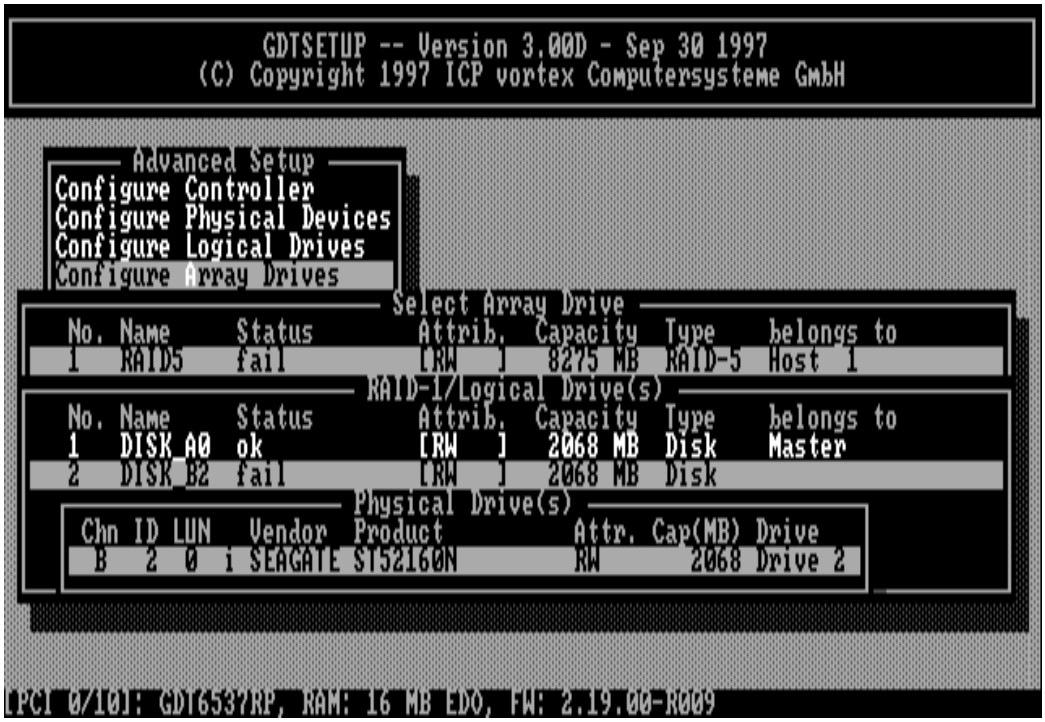
2. RAIDYNE activates the so-called *fail* operation state during which the disk array remains fully operational. The data of the failed drive is calculated by means of the redundant data stored on the other drives.

The alarm signal does not switch off because the disk array, although operational, is found in a state without redundancy, that is, a state which should be eliminated as soon as possible. The alarm signal turns off when GDTSETUP is loaded.
How is this situation reflected in GDTSETUP ?
What has happened to the failed hard disk ?

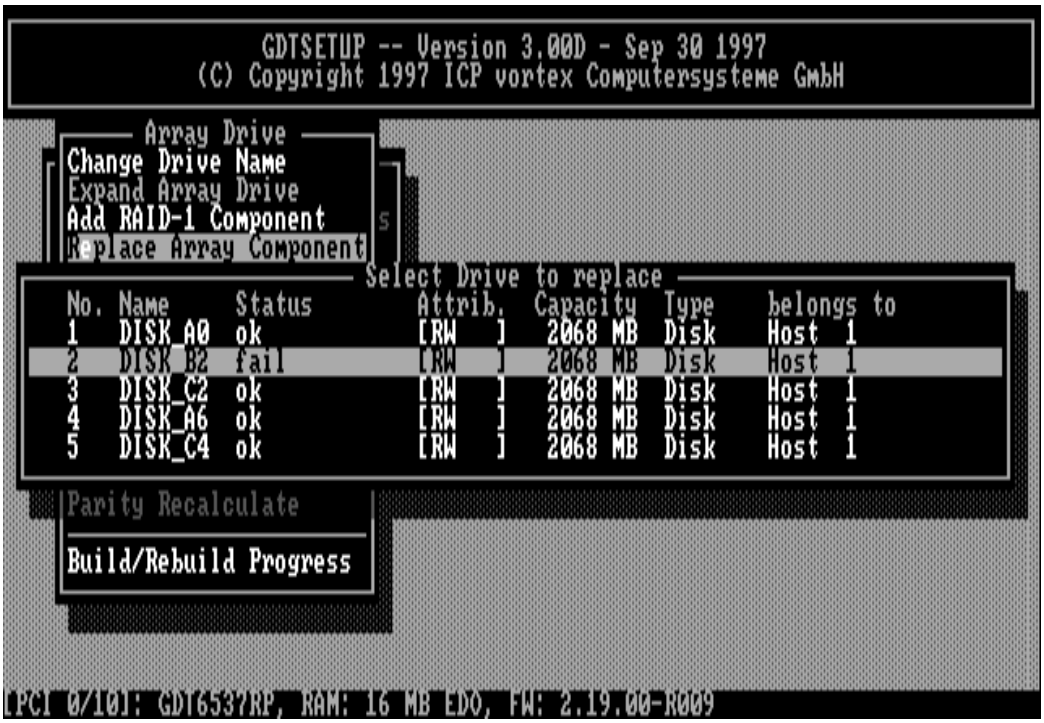
To answer these questions, we load GDTSETUP and check. We go to the menu *Configure Array Drives* menu and select our RAID-5 disk array which entered the *fail* state. Press <F2> to get further information on the failure.


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Configure Array Drives
Select Array Drive
No. Name Status Attrib. Capacity Type belongs to
1 RAID5 fail [RW] 8275 MB RAID-5 Host 1
RAID-1/Logical Drive(s)
No. Name Status Attrib. Capacity Type belongs to
1 DISK_A0 ok [RW] 2068 MB Disk Master
2 DISK_B2 fail [RW] 2068 MB Disk
3 DISK_C2 ok [RW] 2068 MB Disk
4 DISK_A6 ok [RW] 2068 MB Disk
5 DISK_C4 ok [RW] 2068 MB Disk
F2: Drive Information
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

After selecting the failed Logical Drive, press again <F2> to obtain detailed information on the physical drive which has actually failed.


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Configure Array Drives
Select Array Drive
No. Name Status Attrib. Capacity Type belongs to
1 RAID5 fail [RW] 8275 MB RAID-5 Host 1
RAID-1/Logical Drive(s)
No. Name Status Attrib. Capacity Type belongs to
1 DISK_A0 ok [RW] 2068 MB Disk Master
2 DISK_B2 fail [RW] 2068 MB Disk
Physical Drive(s)
Chn ID LUN Vendor Product Attr. Cap(MB) Drive
B 2 0 i SEAGATE ST52160N RW 2068 Drive 2
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

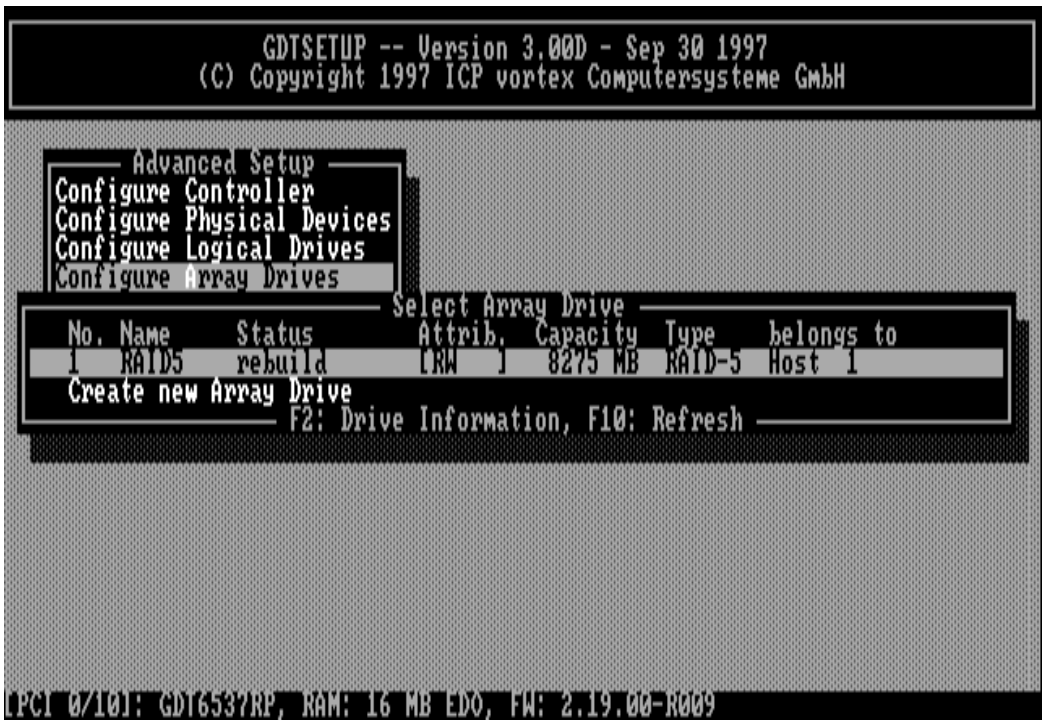
Important: Even if we reconnected the power supply to DISK_B2 before loading GDTSETUP, DISK_B2 would not be included in the disk array again. If you decide to use the failed hard disk again, it is best if you reconnect the drive to the power supply and do a cold boot.
After loading GDTSETUP select the *Configure Array Drives* menu. Select the *Replace Array Component* menu


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Array Drive
Change Drive Name
Expand Array Drive
Add RAID-1 Component
Replace Array Component
Select Drive to replace
No. Name Status Attrib. Capacity Type belongs to
1 DISK_A0 ok [RW] 2068 MB Disk Host 1
2 DISK_B2 fail [RW] 2068 MB Disk Host 1
3 DISK_C2 ok [RW] 2068 MB Disk Host 1
4 DISK_A6 ok [RW] 2068 MB Disk Host 1
5 DISK_C4 ok [RW] 2068 MB Disk Host 1
Parity Recalculate
Build/Rebuild Progress
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

Press <ENTER> . GDTSETUP recognises the previously failed drive again (it was not really defective) and asks if it should be integrated into the disk array again.

GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Array Drive
Change Drive Name
Expand Array Drive
Add RAID-1 Component
Replace Array Component
Select Drive to replace
No. Name
The failed drive is available again !
Do you want to install it in the array ? (Y/N)
1 DISK_A0
2 DISK_B2
3 DISK_C2
4 DISK_A6 ok [RW] 2068 MB Disk Host 1
5 DISK_C4 ok [RW] 2068 MB Disk Host 1
Parity Recalculate
Build/Rebuild Progress
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

Answer <Yes> and the disk array changes its state into *rebuild*. After leaving GDTSETUP the controller begins the reconstruction of the data of the failed drive.


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Configure Array Drives
Select Array Drive
No. Name Status Attrib. Capacity Type belongs to
1 RAID5 rebuild [RW] 8275 MB RAID-5 Host 1
Create new Array Drive
F2: Drive Information, F10: Refresh
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

After the completion of this process, the disk array's state changes into *ready* again.

A few words on the replacement of a defective hard disk of a disk array.
If a hard disk belonging to a disk array for which no Hot Fix drive had been assigned should fail, you should replace this defective hard disk with a new one *as soon as possible*. Always be

aware of the fact that this disk array does not have any redundancy until the defective hard disk has been substituted. This means that if another hard disk should fail while the disk array is without redundancy, all data is irretrievably lost. RAIDYNE offers two possibilities of replacing a failed drive of an array for which no Hot Fix drive has been designated:

1. Replacement with GDTSETUP (we have just demonstrated this method)
2. Replacement by using the **Hot Plug function of GDTMON**

The Hot Plug method allows you to replace a defective drive while the disk array continues to work and without having to load GDTSETUP. When this method is used, the GDT SCSI bus to which the defective drive is connected, is temporarily halted (that is, for the time necessary for replacement), thus enabling you to disconnect the defective drive from the SCSI bus without any risk. After the replacement, the SCSI channel halt is lifted again and RAIDYNE automatically begins to rebuild the new drive. The halting and release of the GDT SCSI channel is controlled by GDTMON, which is available for most operating systems supported by the ICP Controller. The above mentioned halt of the SCSI bus serves to avoid that interferences (spikes and glitches) which inevitably occur on the SCSI bus when the defective drive is disconnected, impair the functioning of still intact drives on this SCSI channel. However, this implies that none of the SCSI devices of the halted SCSI channel can be accessed during the time the defective drive is being exchanged. If all drives forming the disk array are connected to one single SCSI channel the entire disk array cannot be accessed during the time of replacement. Therefore, it is evident that the ICP Controller should have as many SCSI channels as possible and that all SCSI devices should be distributed equally to the available channels in order to avoid that the disk array or other SCSI devices cannot be accessed during the Hot Plug drive replacement. The Hot Plug should be carried out as quickly as possible.
The ICP Controllers also support the Intelligent Fault Bus (DEC ™ fault bus) and SAF-TE. Both industry standards allow for a replacement without any program interaction. Simply unplug the defective drive and plug in a new one. To make use of this very comfortable methods, an intelligent subsystem (supporting either the Intelligent Fault Bus, or SAF-TE) is required.

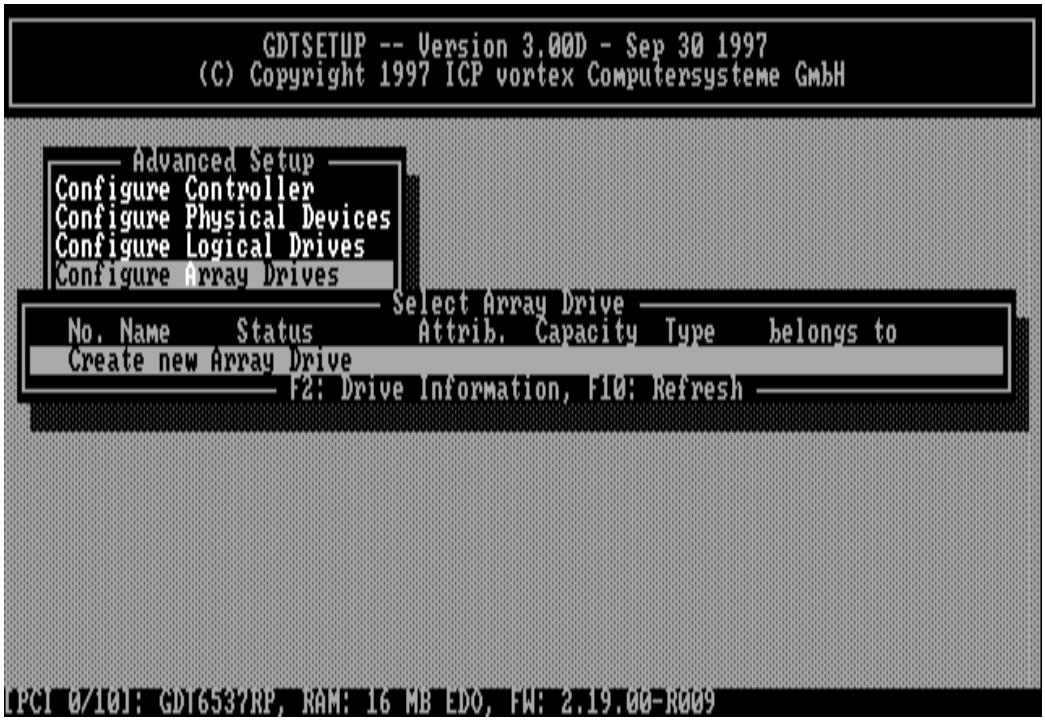
We would like to stress that the Hot Fix method is by far the most secure method of replacing a defective drive while the disk array is operational (see next example). First of all, because it is completely automatic, and secondly because it does not imply any mechanical or electrical interventions on the disk array as the Hot Plug method does.
We shall explain GDTMON and the Hot Plug method more thoroughly later in this manual.

C.9 Example 4 - RAID 5 Disk Arrays With a Hot Fix Drive

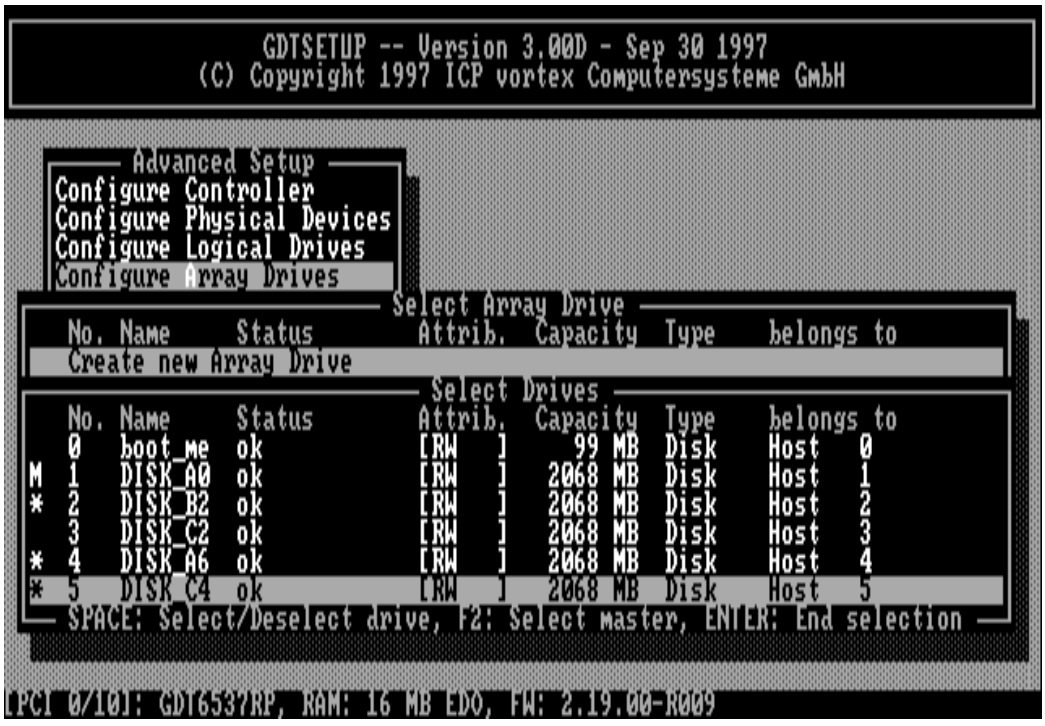
This example is applicable to ICP Controllers with the RAIDYNE firmware. What we call **Hot Fix** drives is referred to as **Host Spare** drives in some literature. Most part of the installation is carried out as in our third example, so we do not repeat the explanation.
Do Step 1, Step 2 and Step 3 as described in example no. 3.

Step 4: Configure Array Drives

We now leave level 2 (by pressing the <ESC>-key) and are back in the main menu. Now, with the cursor keys ↑ and ↓ select *Configure Array Drives* and go to level 3 by pressing <ENTER>.

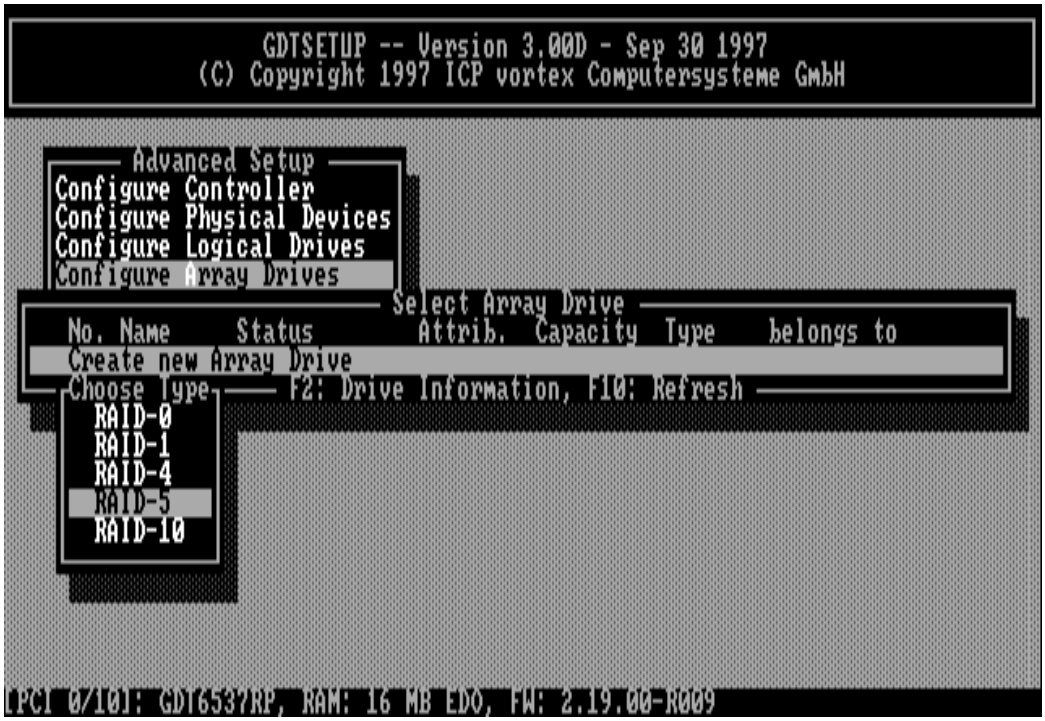

GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Configure Array Drives
Select Array Drive
No. Name Status Attrib. Capacity Type belongs to
Create new Array Drive
F2: Drive Information, F10: Refresh
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

Press <ENTER>. (Note: the Host Drive boot_me is not relevant for our example). Select one by one the Logical Drives 1, 2, 4 and 5. Omit Logical Drive 3.

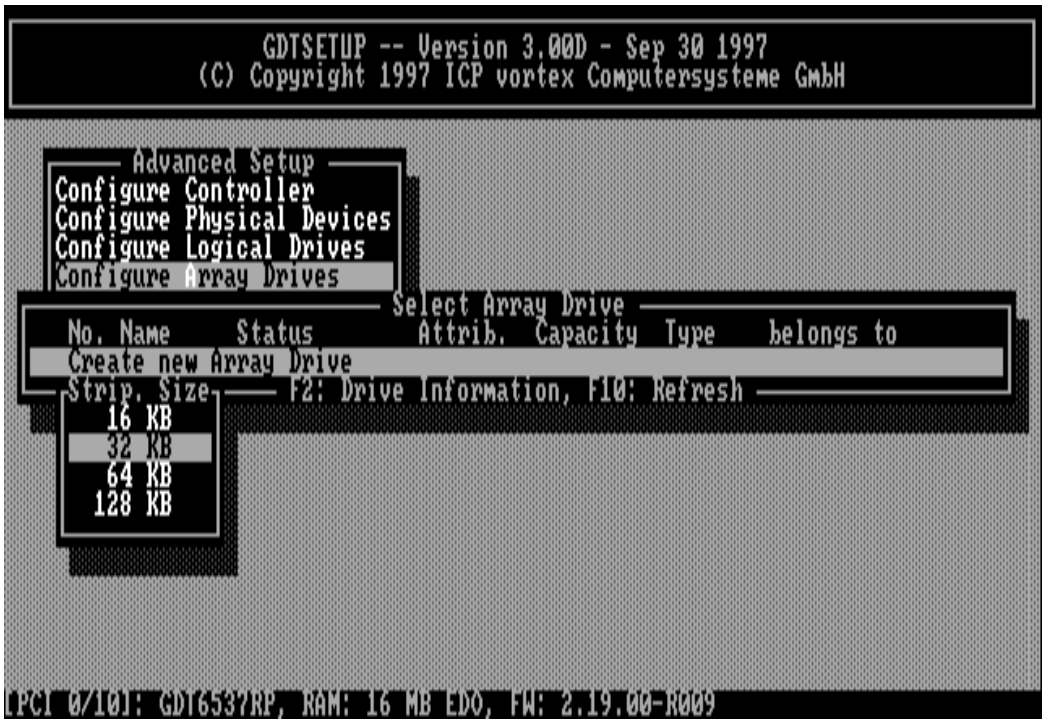

GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Configure Array Drives
Select Array Drive
No. Name Status Attrib. Capacity Type belongs to
Create new Array Drive
Select Drives
No. Name Status Attrib. Capacity Type belongs to
0 boot_me ok [RW] 99 MB Disk Host 0
M 1 DISK_A0 ok [RW] 2068 MB Disk Host 1
* 2 DISK_B2 ok [RW] 2068 MB Disk Host 2
3 DISK_C2 ok [RW] 2068 MB Disk Host 3
* 4 DISK_A6 ok [RW] 2068 MB Disk Host 4
* 5 DISK_C4 ok [RW] 2068 MB Disk Host 5
SPACE: Select/Deselect drive, F2: Select master, ENTER: End selection
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

When the last Logical Drive is selected, confirm with <ENTER>. GDTSETUP now displays a list of possible RAID levels available with the number of Logical Drives selected.

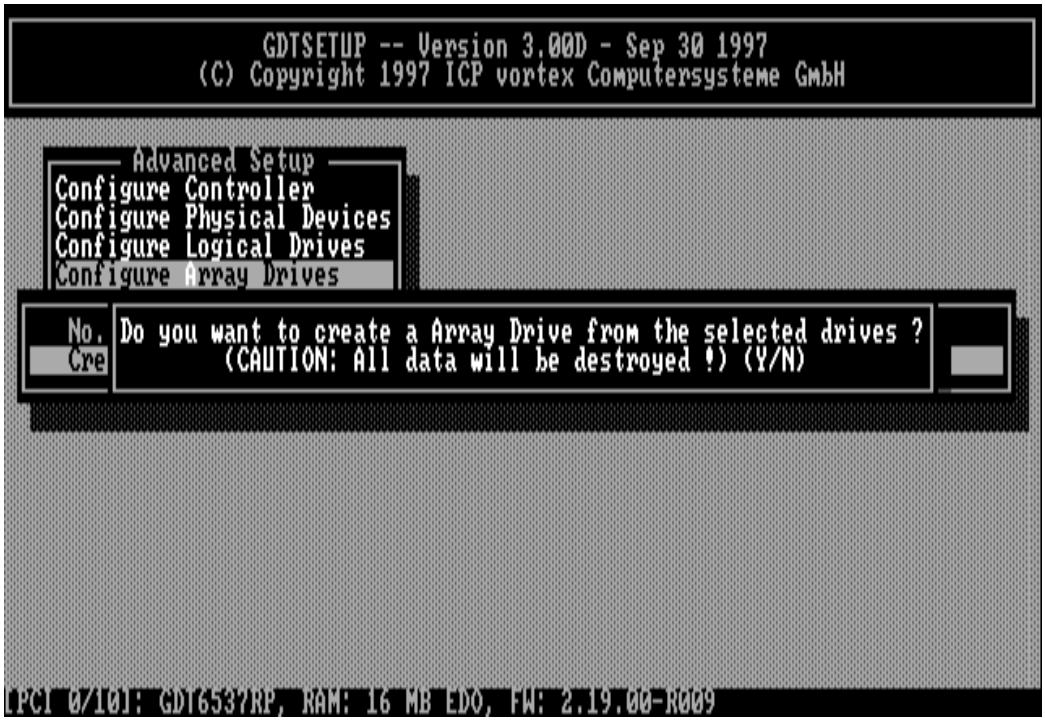
- RAID 0 pure data striping without redundancy
- RAID 1 disk mirroring
- RAID 4 data striping with dedicated parity drive
- RAID 5 data striping with striped parity
- RAID 10 RAID 0 combined with RAID 1



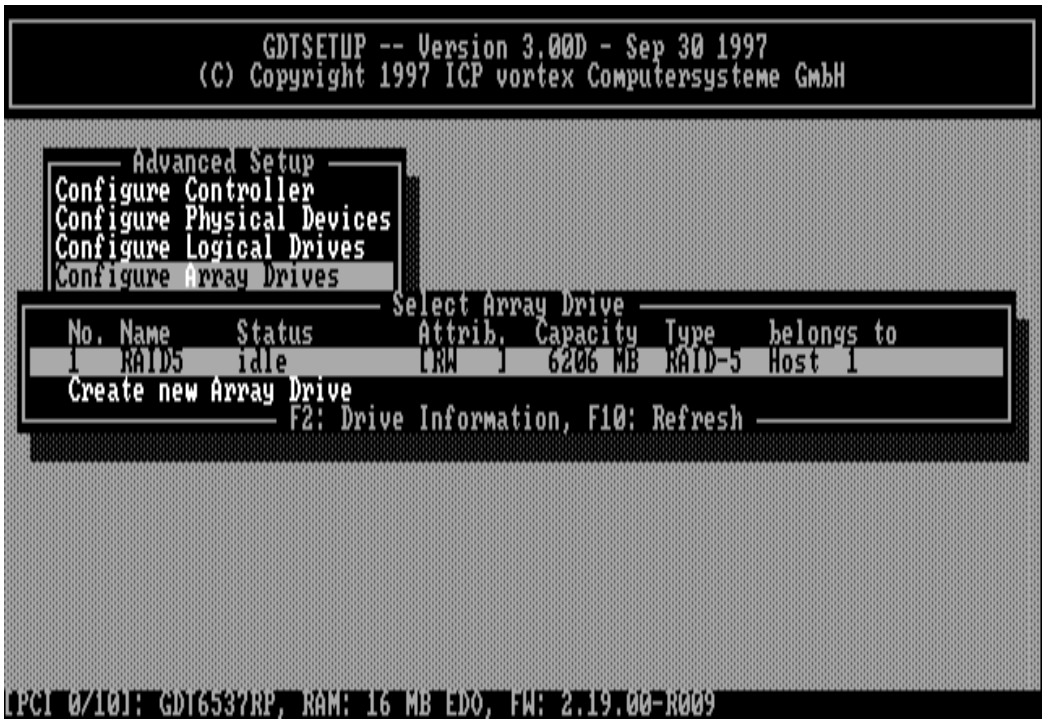
In our case we take RAID-5 and press <ENTER>.



GDTSETUP asks for the *Stripe Size*. This is the size of the stripes into which the data is divided. The default is 32KB which we leave for this example and therefore press <ENTER>. (Note: 32KB stripe size is suggested because in various performance tests it has proved to be the best value.). GDTSETUP displays a security request, which we confirm with <Y>.


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Configure Array Drives
No.
Cre
Do you want to create a Array Drive from the selected drives ?
(CAUTION: All data will be destroyed !) (Y/N)
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

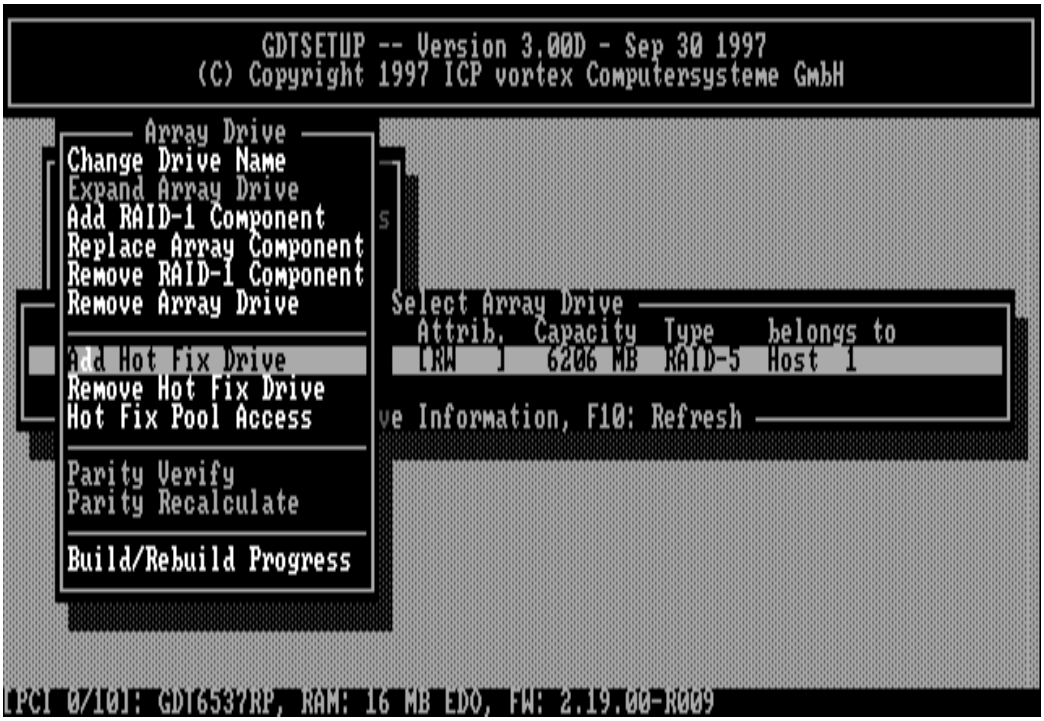
GDTSETUP allows you to limit the capacity of the disk array. This may be of interest if your installation requires an exact size for a disk array. Normally, the full capacity is used. In our example we press <ENTER> .


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Configure Array Drives
Select Array Drive
No. Name Status Attrib. Capacity Type belongs to
1 RAID5 idle [RW] 6206 MB RAID-5 Host 1
Create new Array Drive
F2: Drive Information, F10: Refresh
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

We succeeded in setting up a RAID 5 disk array. The screen shows that the disk array is currently in an *idle* state. Later in this chapter, we shall explain the different states a RAIDYNE disk array can assume.

Step 5: Creating a Hot Fix Drive

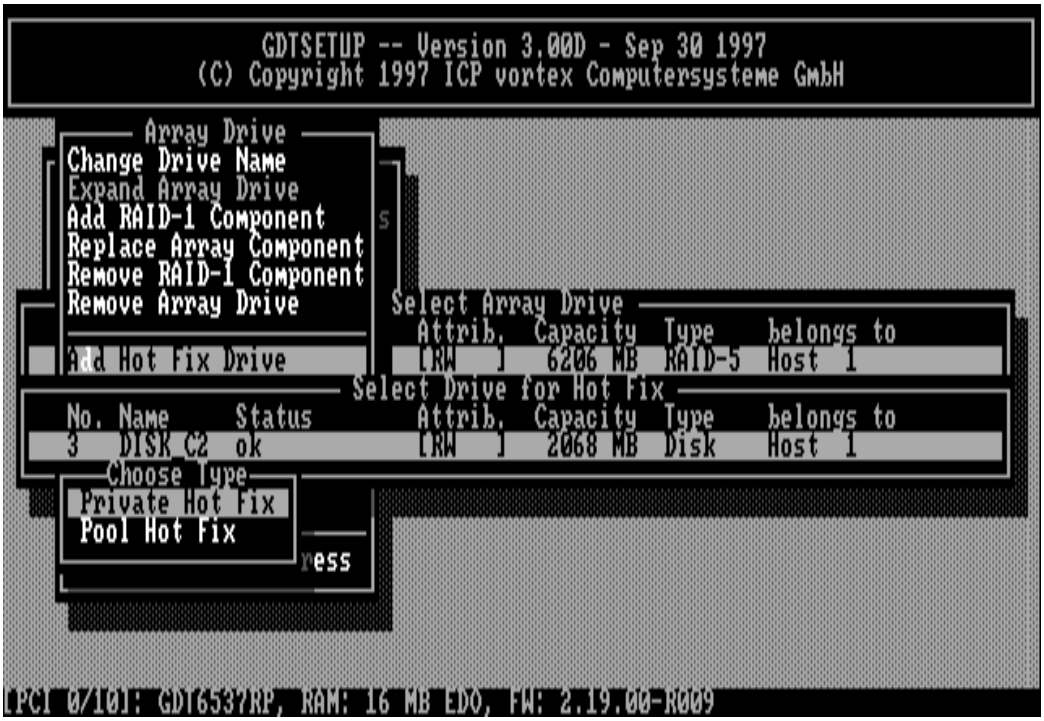
Press again <ENTER> and move the selection bar to the *Add Hot Fix Drive* menu.


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Array Drive
Change Drive Name
Expand Array Drive
Add RAID-1 Component
Replace Array Component
Remove RAID-1 Component
Remove Array Drive
Add Hot Fix Drive
Remove Hot Fix Drive
Hot Fix Pool Access
Parity Verify
Parity Recalculate
Build/Rebuild Progress
Select Array Drive
Attrib. Capacity Type belongs to
[RW] 6206 MB RAID-5 Host 1
ve Information, F10: Refresh
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

Press <ENTER>. GDTSETUP now displays a new dialog-box containing all the Logical Drives apt to serve as a Hot Fix drive (one criterion for this suitability is the drive's capacity, i.e., it has to be large enough). So do not be surprised if you do not find all the drives you would have expected during later installations. GDTSETUP knows which drives are suited to be used as Hot Fix drives. In our example, GDTSETUP offers the Logical Drive we have omitted during the configuration of the Array Drive.

GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Array Drive
Change Drive Name
Expand Array Drive
Add RAID-1 Component
Replace Array Component
Remove RAID-1 Component
Remove Array Drive
Add Hot Fix Drive
Parity Recalculate
Build/Rebuild Progress
Select Array Drive
Attrib. Capacity Type belongs to
[RW] 6206 MB RAID-5 Host 1
Select Drive for Hot Fix
No. Name Status Attrib. Capacity Type belongs to
3 DISK_C2 ok [RW] 2068 MB Disk Host 1
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

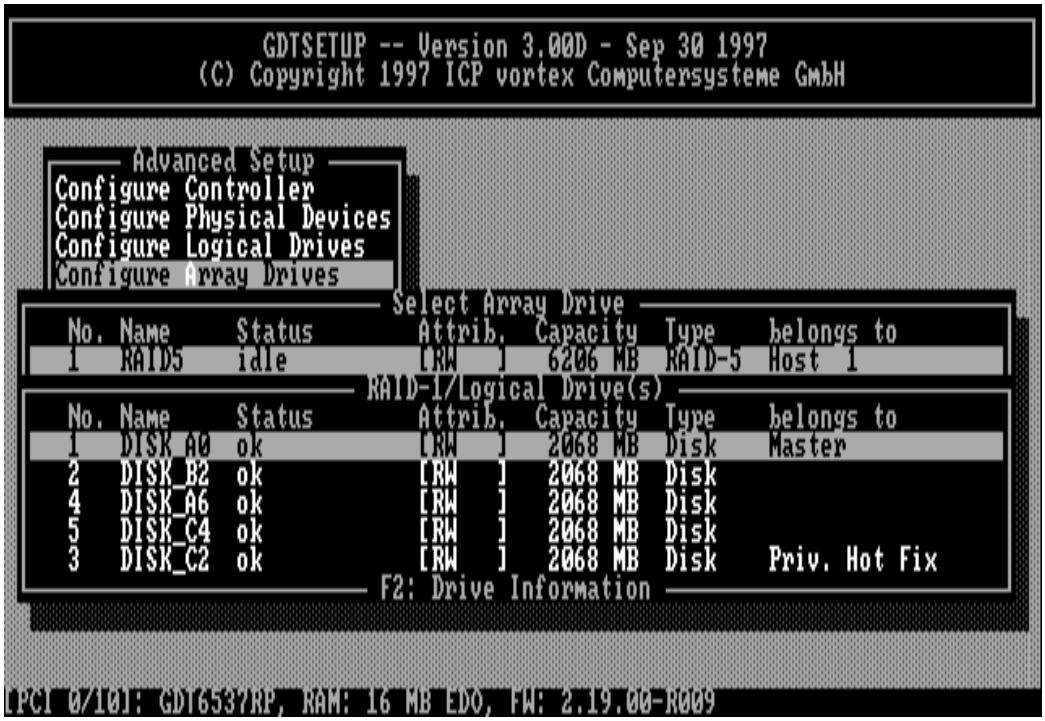
Press <ENTER>.


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Array Drive
Change Drive Name
Expand Array Drive
Add RAID-1 Component
Replace Array Component
Remove RAID-1 Component
Remove Array Drive
Add Hot Fix Drive
Select Array Drive
Attrib. Capacity Type belongs to
[RW] 6206 MB RAID-5 Host 1
Select Drive for Hot Fix
No. Name Status Attrib. Capacity Type belongs to
3 DISK_C2 ok [RW] 2068 MB Disk Host 1
Choose Type
Private Hot Fix
Pool Hot Fix
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

GDTSETUP offers two different Hot Fix types: A *private* Hot Fix drive is only available for one specific disk array. A Hot Fix drive in a Hot Fix P*ool* can be made available to several disk arrays (presuming that the capacity fits). In our example we choose the P*rivate* H*ot* F*ix* drive and press <ENTER> .

GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Array Drive
Change Drive Name
Expand Array Drive
Add RAID-1 Component
Replace Array Component
Remove RAID-1 Component
Remove Array Drive
Select Array Drive
Do you want to add the drive to the array ? (Y/N)
No. Name Status Attrib. Capacity Type belongs to
3 DISK_C2 ok [RW] 2068 MB Disk Host 1
Parity Recalculate
Build/Rebuild Progress
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

Attention: By turning a Logical Drive into a Hot Fix drive, all its data is irretrievably lost.


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Configure Array Drives
Select Array Drive
No. Name Status Attrib. Capacity Type belongs to
1 RAID5 idle [RW] 6206 MB RAID-5 Host 1
RAID-1/Logical Drive(s)
No. Name Status Attrib. Capacity Type belongs to
1 DISK_A0 ok [RW] 2068 MB Disk Master
2 DISK_B2 ok [RW] 2068 MB Disk
4 DISK_A6 ok [RW] 2068 MB Disk
5 DISK_C4 ok [RW] 2068 MB Disk
3 DISK_C2 ok [RW] 2068 MB Disk Priv. Hot Fix
F2: Drive Information
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

After pressing <F2> we get detailed information on the structure of the disk array. The last entry refers to the *Priv. Hot Fix* drive.
We have already seen this form before, with the only difference that DISK_C2 has been assigned to be the Hot Fix drive. We now leave GDTSETUP as described in example no. 3, in order to allow GDTSETUP to send all relevant information to the controller and let RAIDYNE create and store the redundant information.

The question that arises now is:

When and how does the Hot Fix mechanism work ?
Normally, RAIDYNE puts Hot Fix drives in a stand-by mode, that is, their motors are stopped. However, it may happen that certain operations such as loading drivers, starting GDTSETUP and so on, cause the Hot Fix drives to start their motors. This takes a little bit longer, but it is necessary in order to enable RAIDYNE to check the consistency of the setup. RAIDYNE substitutes a failed hard disk with a Hot Fix drive only if the array was in a *ready* state before the failure. Or, in other words, a Hot Fix drive can only be activated if the corresponding disk array was in a state of data redundancy at the moment of failure.
Important: The following partial step can only be performed if the disk array is in the *ready* state.

Step 6: Simulating a Hard Disk Failure When a Hot Fix Drive is Present.

This partial step is optional. However, we recommend that you carry it out in order for you to get an idea of how RAIDYNE reacts in such a situation and which steps need to be taken. To have a very realistic simulation, create a DOS-partition and generate load on your disk array by using a batch file with copy commands. During these copy operations we cause DISK_B2 to fail by plugging out its power supply. (If you choose to let another drive fail, keep in mind the section of step 1 referring to the SCSI-bus termination).
We now observe how RAIDYNE reacts:

1. After a short while, GDT's alarm signal is heard.
   (Note: the alarm only goes on when the RAID 5 Array Drive is accessed.)

2. RAIDYNE activates the so-called *fail* operation mode. In this mode, the disk array remains fully operational. The data of the failed drive is reconstructed by means of the redundancy information stored on the other drives.

3. RAIDYNE starts the motor of the Hot Fix drive.

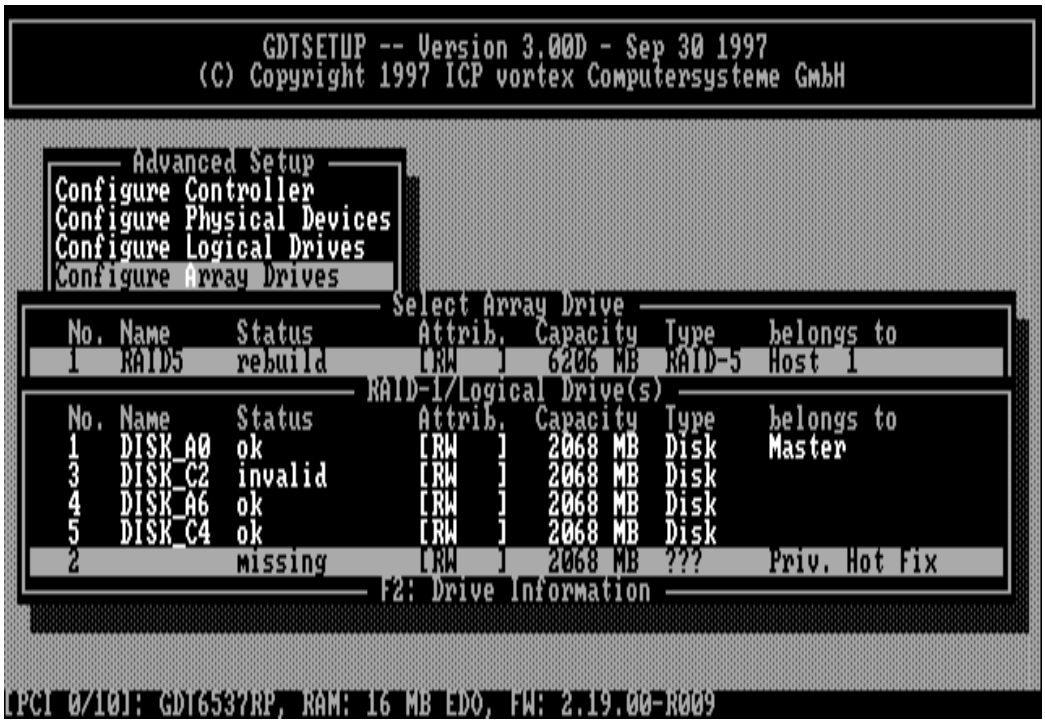
4. RAIDYNE includes the Hot Fix drive into the disk array and starts to reconstruct the data and redundancy information. The disk array is now in the operation mode *rebuild*.

5. The alarm signal is not turned off until a new Hot Fix drive is added to the disk array, or until GDTSETUP (or GDTMON) is loaded and the missing Hot Fix drive is removed or replaced with a new one.

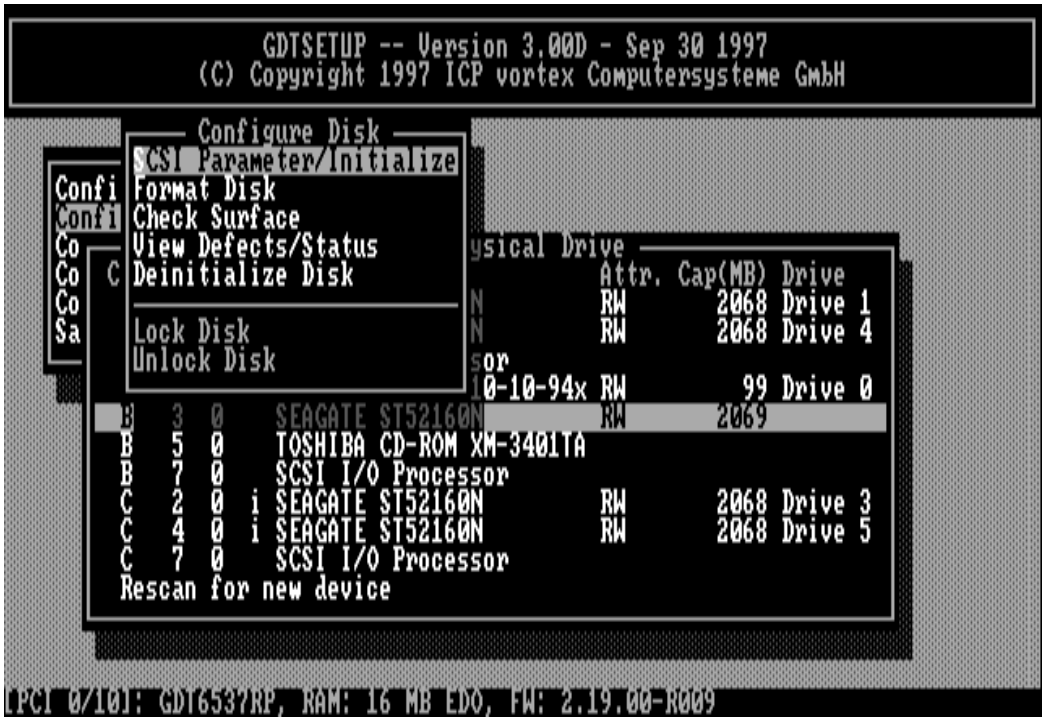
Obviously, no other hard disk may fail until all data is entirely reconstructed on the Hot Fix drive, because up to that moment the system operates without redundancy.

How is this situation reflected in GDTSETUP?
What has happened to the failed drive ?

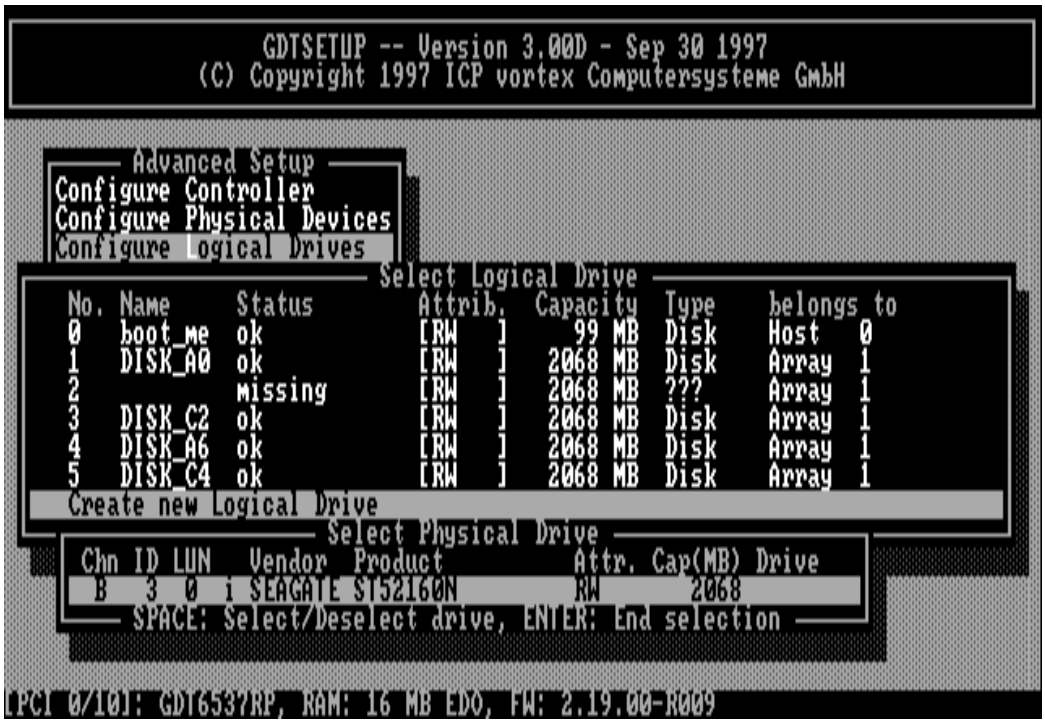
To answer these and other questions we load GDTSETUP and check. We go directly to the menu *Configure Array Drive* menu. As expected, the disk array is in the *rebuild* state. Request the drive information regarding the RAID5 disk array with <F2>.


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Configure Array Drives
Select Array Drive
No. Name Status Attrib. Capacity Type belongs to
1 RAID5 rebuild [RW] 6206 MB RAID-5 Host 1
RAID-1/Logical Drive(s)
No. Name Status Attrib. Capacity Type belongs to
1 DISK_A0 ok [RW] 2068 MB Disk Master
3 DISK_C2 invalid [RW] 2068 MB Disk
4 DISK_A6 ok [RW] 2068 MB Disk
5 DISK_C4 ok [RW] 2068 MB Disk
2 missing [RW] 2068 MB ??? Priv. Hot Fix
F2: Drive Information
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

Two changes have occurred. The Hot Fix drive DISK_C2 has the state *invalid* and has jumped into the position of DISK_B2. DISK_B2 is missing (this is the drive we let fail (disconnected it from the DC power). Since this disk array was configured to have a hot fix drive, this position is still in the list, with the attribute *missing*.
Leave GDTSETUP and when you are back at the MS-DOS prompt, switch off the system. We now want to add a new Hot Fix drive to the disk array. For our example we take a brand new drive, set its SCSI ID to 3 and connect it to the connector of SCSI channel B, where the previously failed drive was connected to and to the DC-power supply. Before switching on the system again, check that the SCSI termination of the new drive is identical to the old one. After switching on the system again, load GDTX000 and GDTSETUP and initialize the new drive.


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Configure Disk
SCSI Parameter/Initialize
Format Disk
Check Surface
View Defects/Status
Deinitialize Disk
Lock Disk
Unlock Disk
Attr. Cap(MB) Drive
RW 2068 Drive 1
RW 2068 Drive 4
10-10-94x RW 99 Drive 0
B 3 0 SEAGATE ST52160N RW 2069
B 5 0 TOSHIBA CD-ROM XM-3401TA
B 7 0 SCSI I/O Processor
C 2 0 i SEAGATE ST52160N RW 2068 Drive 3
C 4 0 i SEAGATE ST52160N RW 2068 Drive 5
C 7 0 SCSI I/O Processor
Rescan for new device
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

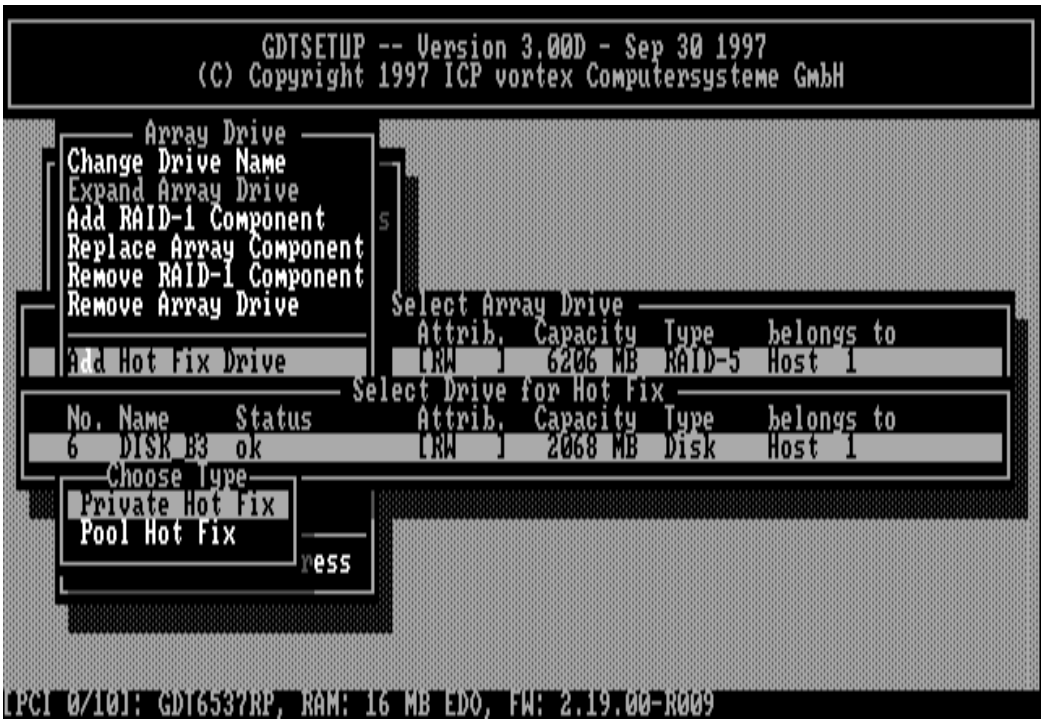
In the next step we setup a new Logical Drive:


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Select Logical Drive
No. Name Status Attrib. Capacity Type belongs to
0 boot_me ok [RW] 99 MB Disk Host 0
1 DISK_A0 ok [RW] 2068 MB Disk Array 1
2 missing [RW] 2068 MB ??? Array 1
3 DISK_C2 ok [RW] 2068 MB Disk Array 1
4 DISK_A6 ok [RW] 2068 MB Disk Array 1
5 DISK_C4 ok [RW] 2068 MB Disk Array 1
Create new Logical Drive
Select Physical Drive
Chn ID LUN Vendor Product Attr. Cap(MB) Drive
B 3 0 i SEAGATE ST52160N RW 2068
SPACE: Select/Deselect drive, ENTER: End selection
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

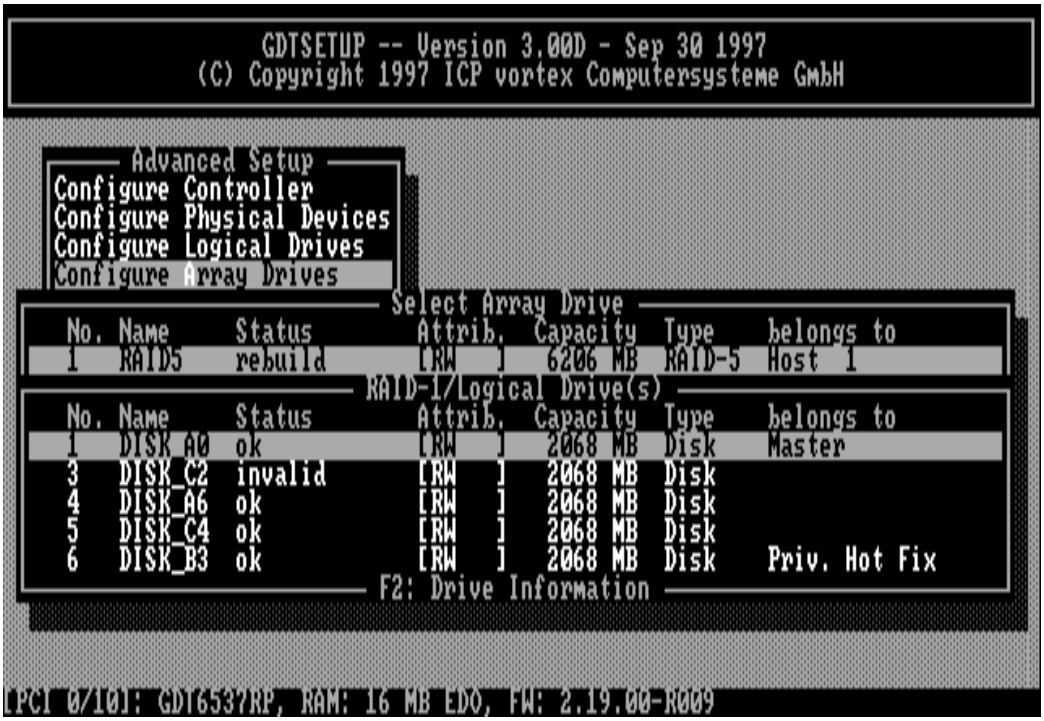
DISK_B3 is our new Logical Drive, which we want to use as a new Hot Fix drive.
Change to the *Configure Array Drives* menu. Select our Disk Array and press <ENTER>.

GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Array Drive
Change Drive Name
Expand Array Drive
Add RAID-1 Component
Replace Array Component
Remove RAID-1 Component
Remove Array Drive
Add Hot Fix Drive
Parity Recalculate
Build/Rebuild Progress
Select Array Drive
Attrib. Capacity Type belongs to
[RW] 6206 MB RAID-5 Host 1
Select Drive for Hot Fix
No. Name Status Attrib. Capacity Type belongs to
6 DISK_B3 ok [RW] 2068 MB Disk Host 1
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

Select *Add Hot Fix Drive* and thereafter DISK_B3.


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Array Drive
Change Drive Name
Expand Array Drive
Add RAID-1 Component
Replace Array Component
Remove RAID-1 Component
Remove Array Drive
Add Hot Fix Drive
Select Array Drive
Attrib. Capacity Type belongs to
[RW] 6206 MB RAID-5 Host 1
Select Drive for Hot Fix
No. Name Status Attrib. Capacity Type belongs to
6 DISK_B3 ok [RW] 2068 MB Disk Host 1
Choose Type
Private Hot Fix
Pool Hot Fix
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

Select P*rivate Hot Fix* and press <ENTER> .
Press <F2> to get the configuration information on this disk array.
As we can see from the list, DISK_B3 has become the new Hot Fix drive for our RAID5 disk array.


GDTSETUP -- Version 3.00D - Sep 30 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Configure Array Drives
Select Array Drive
No. Name Status Attrib. Capacity Type belongs to
1 RAID5 rebuild [RW] 6206 MB RAID-5 Host 1
RAID-1/Logical Drive(s)
No. Name Status Attrib. Capacity Type belongs to
1 DISK_A0 ok [RW] 2068 MB Disk Master
3 DISK_C2 invalid [RW] 2068 MB Disk
4 DISK_A6 ok [RW] 2068 MB Disk
5 DISK_C4 ok [RW] 2068 MB Disk
6 DISK_B3 ok [RW] 2068 MB Disk Priv. Hot Fix
F2: Drive Information
[PCI 0/10]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

DISK_C2 is still *invalid* (this was our former Hot Fix drive), since the rebuild process is not yet completed.

C.10 Trying to Answer The Initial Questions

Now, after having demonstrated with examples 3 and 4 how RAID disk arrays are created with RAIDYNE (we hope you enjoyed it), we would like to return to the questions set down at the beginning of this chapter. When planning a disk array it is essential that you have precise ideas on how you intend to configure the disk array.

C.10.1 How Many Hard Disks Should be Integrated Into the Disk Array ?

To answer this question let us have a look at the delimiting parameters, that is, the maximum and minimum number of drives. The **maximum number** of physical drives in a disk array is determined by the number of physical drives the ICP Controller can control (with a two-channel ICP Controller this number amounts to 14, with a three channel ICP Controller to 21). In this context, we cannot analyze the many various factors which influence the decision of whether to integrate all Host Drives into one single RAID Host Drive, or rather create a number of smaller RAID Host Drives instead. The **minimum number** of necessary hard disks depends on the RAID level you wish to realize.

RAID Level	Type of Disk Array	Minimum number of hard disks
RAID 0	data striping	2
RAID 1	disk mirroring	2
RAID 4	data striping with parity drive	3
RAID 5	data striping with striped parity	3
RAID 10	data striping and mirroring	4

The desired usable disk space of the disk array as well as the following two issues have a direct impact on the number of physical hard disks needed.

C.10.2 Which Level of Redundancy is Needed ?

To come straight to the point, **RAID 0** (data striping) does not imply any redundancy at all (the **R** in front of the **AID** is rather misleading). On the other hand, a RAID 0 disk array is pretty fast, since no parity information is required. With **RAID 1** (disk mirroring), the data is 100% redundant because it is mirrored. This is definitely the highest level of redundancy, but the most expensive one, too. An interesting combination of RAID levels 0 and 1 is **RAID 10.** Two RAID 0 stripe sets are simply mirrored. If one drive fails, the data are still available on the mirrored drive. With **RAID 4** (data striping with dedicated drive) and **RAID 5** (data striping with striped parity), parity information is calculated from the present data with a simple mathematical operation (eXclusive OR, XOR), and stored either to one dedicated drive (RAID 4) or to all drives (RAID 5). If one drive should fail, the data of the defective drive can be reconstructed on the basis of the normal user data and the previously calculated parity data. RAID levels 4, 5 and 10 can tolerate the failure of one drive just as RAID 1, but in comparison to the latter, RAID 4, RAID 5 or RAID 10 are less expensive.
As already mentioned before, the entire disk array controlling function is carried out at controller level and therefore does not load the host computer.
Let us have a look at the following table which explains the correlations between the RAID level, usable disk capacity and number of physical hard disks. To make things easier, we consider identical 1 GB hard disks:

Usable storage capacity of the disk array

RAID Level	2 hard disks	3 hard disks	4 hard disks	5 hard disks
RAID 0	2GB	3GB	4GB	5GB
RAID 1	1GB	1GB	1GB	1GB
RAID 4	-	2GB	3GB	4GB
RAID 5	-	2GB	3GB	4GB
RAID 10	-	-	2GB	-

It is quite obvious that the redundancy of level RAID 1 soon becomes very expensive when more than 2 hard disks are used. Only with RAID 4 and RAID 5 have you a reasonable relation between storage capacity and expenses for the disk array.

C.10.3 Do we Need Hot Fix drives ?

In other words: Should RAIDYNE automatically reconstruct the lost data after a hard disk failure ?
One of the reasons that have led you to choose **R**AID disk arrays definitely lies with the **r**edundancy, that is, the data security you still preserve even in the event of disk failure, thus resting assured against loss of data and time.
Hot Fix drives are possible with all RAID 1, 4, 5 and 10 disk arrays.

In order to assist the following considerations, we define the term ***time without redundancy*, TWR**. Set apart the time needed to set up the disk array (state *build*), the time without redundancy should be kept as short as possible. Let us assume that one of the hard disks of the RAID 5 disk array we set up with example 1 fails. The disk array is without redundancy. TWR starts to run. Any superfluous prolongation of the TWR (because you have to get a replacement drive, or because you did not realize the failure immediately since you didn't hear the ICP Controller's alarm signal, or because nobody checked the file server) increases the risk of data loss which will occur if a second drive should fail. Therefore, new redundancy should be created as soon as possible and in an entirely automated manner. Integrating a Hot Fix drive as an immediately available and auto-replacing drive is the only way to keep the TWR as short as possible. Only a Hot Fix drive can ensure optimal disk array security and constant data availability. Of course a Hot Fix drive is not compulsory. If you control the disk array at regular intervals and immediately replace a defective drive (by shutting down the system or hot-plugging), you can do without a Hot Fix drive.

C.11 States of a RAIDYNE Disk Array

An Array Drive under the RAIDYNE operating system can assume seven different operational modes: **Idle, Ready, Fail, Build, Rebuild, Expand and Error.**

C.11.1 "Idle" State

This state is characterized by the fact that the redundant information of the disk array has never been entirely created. The disk array is in this state after its first configuration and until you quit GDTSETUP. If an error should occur while the array is in the *build* state, the array returns to the *idle* state (exception: if during *build* mode the dedicated drive of RAID 4 fails, the mode changes to *fail*).

C.11.2 "Build" State

After the disk array has been configured for the first time, it assumes the *build* state as soon as you quit GDTSETUP. While the array is in the *build* state, redundancy information is calculated and stored to the hard disks of the array.

C.11.3 "Ready" State

The disk array is fully operational when in the *ready* state. All redundant information is present, that is, a hard disk can fail without impairing the functionality of the disk array. This is the normal state of a disk array. The state *ready/expand* indicates, that the RAID level and/or capacity are currently migrated/expanded.

C.11.4 "Fail" State

The disk array changes to the *fail* state whenever a Logical Drive fails. Redundancy information is still present, thus allowing the remaining hard disks to continue working. This state should be eliminated as soon as possible by replacing the defective hard disk. If a so-called Hot Fix drive has previously been assigned to a disk array with GDTSETUP, the controller will automatically replace the defective drive and start the reconstruction of the data and the redundant information. Therefore, under these circumstances the *fail* state is only temporary and will be eliminated by the controller itself.

C.11.5 "Rebuild" State

The disk array will assume this state after the automatic activation of a Hot Fix drive or after a manual replacement carried out with GDTSETUP. The data and the redundant information are reconstructed and stored to the new drive.

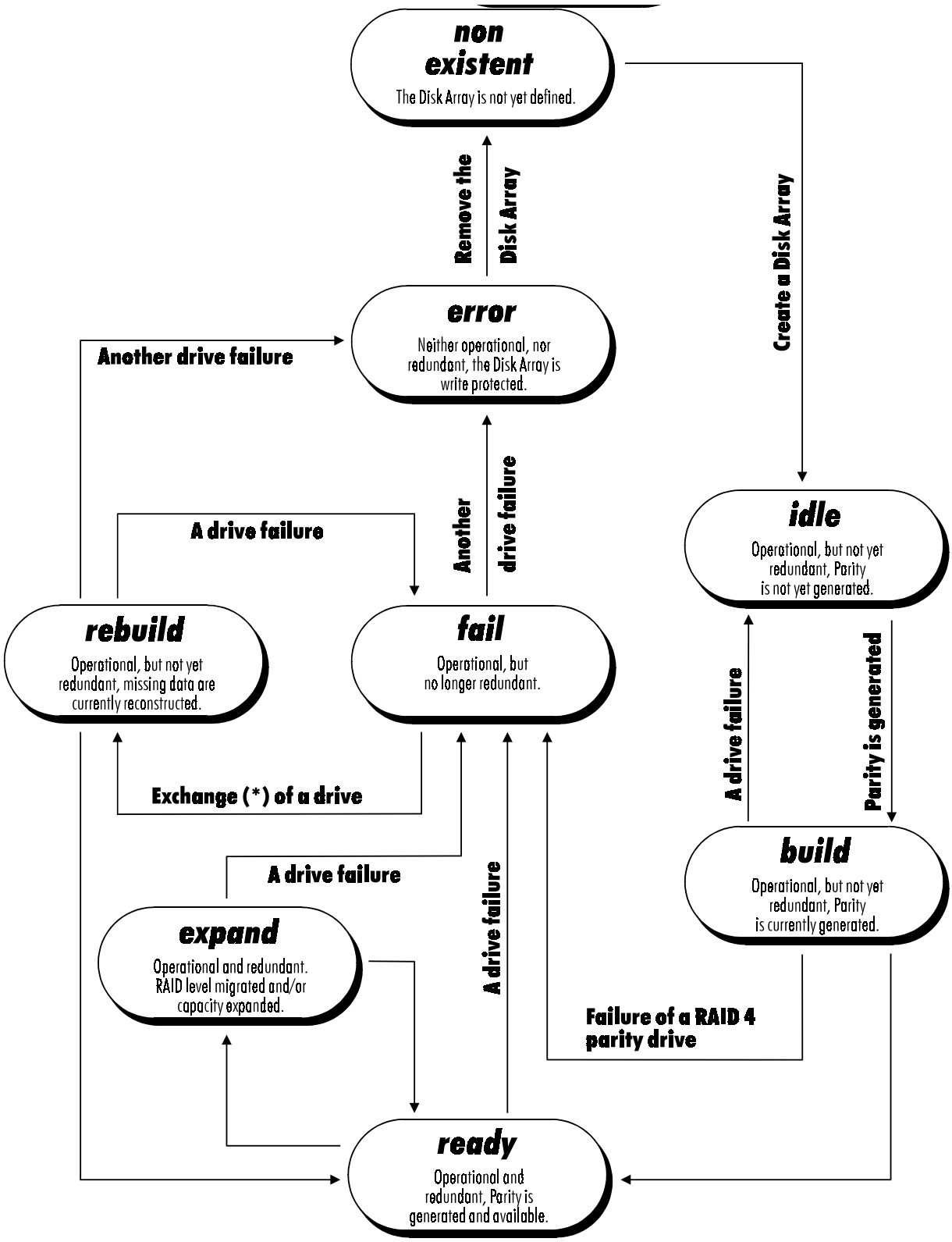
C.11.6 "Expand" State

If the capacity or RAID level of an existing disk array is changed, the disk array changes its state into *expand*. As soon as the expansion or migration is completed, the state changes back to *ready*.

C.11.7 "Error" State

If a second hard disk should fail while the disk array is in the *fail* or *rebuild* state, it is not possible to continue the working session without restrictions. The disk array is still available for I/Os, but data loss and error messages on the host level are possible.
The following state diagram of the disk array summarizes the states described above and the transitions from one state to another.

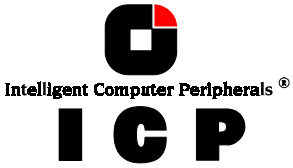
Some of these states may become the addendum ***patch*** (e.g. *build/patch*, *ready/patch*).
This word indicates that the original Array Drive went through a significant procedure. I.e., the parity information was recalculated anew.
Or, the Array Drive has been patched from the error state into the fail state. This may become extremely helpful in a situation where two Logical Drives of an Array Drive, fail at the same time, but only one of the two Logical Drives is really defective and the other was blocked out, since it was connected with the same SCSI channel as the defective one. The Array Drive's state is error and normally all data would be lost. RAIDYNE and GDTSETUP include some functions, which allow the patch of this Array Drive from the error state into the fail sate. Before the actual patch, the defective drive has to be physically removed from the Array Drive. Such a patch-procedure is a real sheet-anchor and should only be used, after a detailed consultation with a trained support person (a printout of the *Save Information* file, is extremely helpful).


non existent
The Disk Array is not yet defined.
Remove the Disk Array
Create a Disk Array
error
Neither operational, nor redundant, the Disk Array is write protected.
Another drive failure
Another drive failure
A drive failure
idle
Operational, but not yet redundant, Parity is not yet generated.
rebuild
Operational, but not yet redundant, missing data are currently reconstructed.
fail
Operational, but no longer redundant.
A drive failure
Parity is generated
Exchange (*) of a drive
A drive failure
build
Operational, but not yet redundant, Parity is currently generated.
expand
Operational and redundant. RAID level migrated and/or capacity expanded.
A drive failure
Failure of a RAID 4 parity drive
ready
Operational and redundant, Parity is generated and available.

(*) Replacement either manually, or through hot fix method.

Chapter D

Using MS-DOS



D. Using Microsoft MS-DOS

After having explained the installation of the ICP Controller and the host-drives in chapters B and C, we now explain how to install the operating system MS-DOS. By using some examples, we shall demonstrate how to partition a host-drive, transfer MS-DOS to the host-drive, install Windows 3.x and use a CD-ROM drive (standing for any other N*ot* D*irect* A*ccess* D*evice*) under MS-DOS. In addition, we will give you further information on how to install **Windows 95.**

D.1 Transparency of Host Drives

The structure of the Host Drives, which have been installed with GDTSETUP (in chapter C), is not known to DOS. i.e., the operating system does not recognize that a given Host Drive consists of a number of hard disks forming a disk array. To DOS this Host Drive simply appears as one single hard disk with the capacity of the disk array. This complete transparency represents the easiest way to operate disk arrays under DOS; neither DOS nor the PCI computer need to be involved in the administration of these complex disk array configurations.

D.2 Partitioning a Host-Drive and Transferring MS-DOS

You can partition the host-drives installed in chapter C with GDTSETUP as well as with the MS-DOS program FDISK. However, in our explanation we shall only use GDTSETUP. For further information on FDISK, please refer to your MS-DOS manual. During the following installation instructions we assume that there is not yet a boot disk in the computer system. Therefore, the following steps aim at installing a *primary* DOS *partition* on the host-drive previously installed with GDTSETUP (see chapter C), activating this partition, and transferring MS-DOS to this partition. Our objective is to be able to boot MS-DOS directly from this partition at the end of the installation. First of all, we would like to draw your attention to a common operating error which is often made when Host Drives are partitioned. Many users ignore that an MS-DOS boot partition has to have the state **"active"**. If the partition is not active, the system will attempt to boot MS-DOS, but will "hang" straight away. Very often, the system message "ROM BASIC NOT FOUND, SYSTEM HALTED" is displayed (in the 40 lines of text mode). You can easily remedy this problem by booting the system from an MS-DOS floppy disk, and then activating the partition with GDTSETUP (more information later in this manual) or FDISK (for more information on FDISK please refer to the MSDOS user's manual).

(A) As already mentioned before, you can load GDTSETUP in two ways. For the partitioning, GDTSETUP has to be loaded from disk under MS-DOS:

Boot the MS-DOS-operating system (either from a boot-floppy or from an already existing boot drive, i.e., IDE-hard disk etc.).

(B) In order for GDTSETUP to work properly, you have to load the device driver GDTX000 first. This can be done in two ways:

Load GDTX000 from the MS-DOS command level by typing in GDTX000<ENTER>, or load GDTX000 automatically through the CONFIG.SYS file (DEVICE=GDTX000.EXE).

Load GDTSETUP from the MS-DOS command level by typing GDTSETUP<ENTER>.

Note: GDTSETUP.EXE as well as GDTX000.EXE are on the *System Disk* - DOS.

(C) Now, in the program GDTSETUP, select the menu C*onfigure* H*ost* D*rives*.

GDTSETUP -- Version 3.04D - Apr 02 1998
(C) Copyright 1997-98 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Configure Array Drives
Configure Host Drives
Save Information
F2: Express Setup
[PCI 0/13]: GDT6519RD, RAM: 16 MB EDO, FW: 2.21.00-RFFF

Pressing <ENTER> leads you to the following sub-menu. In our example, the Host Drive list contains two Host Drives. The first drive in the list is not relevant for our example.

GDTSETUP -- Version 3.04D - Apr 02 1998
(C) Copyright 1997-98 ICP vortex Computersysteme GmbH
Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Configure Array Drives
Configure Host Drives
Select Host Drive
No. Name Status Attrib. Capacity Type belongs to
0 DISK_A1 ok [RW] 2000 MB Disk Logical 0
4 DISK_B3 ok [RW] 8538 MB Disk Logical 4
Create new Host Drive
F2: Drive Information, F10: Refresh
[PCI 0/13]: GDT6519RD, RAM: 16 MB EDO, FW: 2.21.00-RFFF

We select this Host Drive (by moving the selection line with the cursor keys ↑ and ↓) and confirm our choice with <ENTER>. Then the following screen comes up:

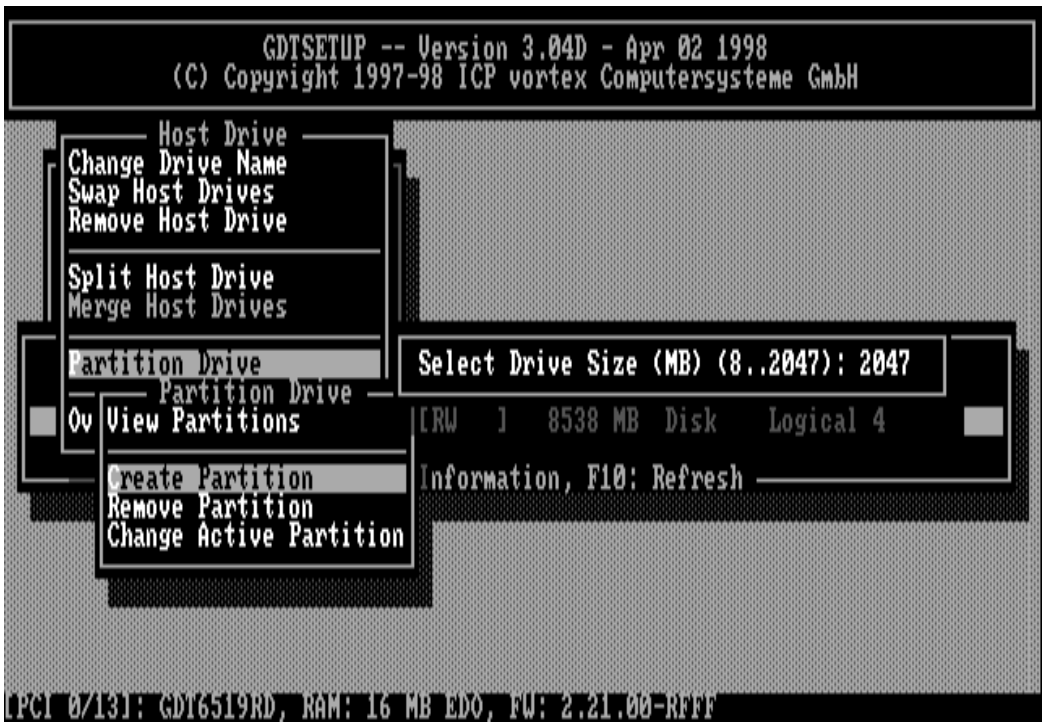
GDTSETUP -- Version 3.04D - Apr 02 1998
(C) Copyright 1997-98 ICP vortex Computersysteme GmbH
Host Drive
Change Drive Name
Swap Host Drives
Remove Host Drive
Split Host Drive
Merge Host Drives
Partition Drive
Overwr. Master Boot Code
Select Host Drive
Attrib. Capacity Type belongs to
[RW] 2000 MB Disk Logical 0
[RW] 8538 MB Disk Logical 4
F2: Drive Information, F10: Refresh
[PCI 0/13]: GDT6519RD, RAM: 16 MB EDO, FW: 2.21.00-RFFF

We now select P*artition* D*rive* and then V*iew* P*artitions*. The following screen appears. In our example, there is no entry yet.

GDTSETUP -- Version 3.04D - Apr 02 1998
(C) Copyright 1997-98 ICP vortex Computersysteme GmbH
Host Drive
Change Drive Name
Swap Host Drives
Remove Host Drive
Split Host Drive
Merge Host Drives
Partition Drive
Select Host Drive
Attrib. Capacity Type belongs to
[RW] 2000 MB Disk Logical 0
[RW] 8538 MB Disk Logical 4
Partition Drive
View Partitions
Partition Table
No. Type Status Start-Cyl End-Cyl Cap(MB) %
1 - 0 0 0 0
2 - 0 0 0 0
3 - 0 0 0 0
4 - 0 0 0 0
[PCI 0/13]: GDT6519RD, RAM: 16 MB EDO, FW: 2.21.00-RFFF

Press <ESC>, select C*reate* P*artition* and press <ENTER>.

In the upcoming window, select P*rimary* P*artition* and confirm with <ENTER>.



Now you can determine the size of the primary partition. In our example, we choose to use 2047MB of the disk capacity for the primary partition and therefore enter 2047 and simply confirm with <ENTER>. Now select *View Partitions* again. You can see that the primary partition has been successfully installed and has the active state (A), which is necessary to boot MS-DOS from this partition.

(D) Now leave GDTSETUP by pressing <ESC>. After a few requests and messages from GDTSETUP, the system reboots.

(E) Now use the MS-DOS program FORMAT to transfer MS-DOS to the primary partition you have just created.
To do so, enter

A:\> FORMAT C: /S <ENTER>

(F) To complete the installation of MS-DOS, use the MS-DOS commands COPY or XCOPY to transfer the desired MS-DOS files.

A different and maybe even more elegant method of installing MS-DOS is to use the SETUP program of MS-DOS versions 5 and 6. In this case, you only have to create and activate a partition with GDTSETUP or FDISK. Then boot the system from the first floppy disk delivered with MS-DOS. MS-DOS SETUP will take care of all the rest.

D.3 CONFIG.SYS and the Driver GDTX000.EXE

GDTX000.EXE is the high performance MS-DOS driver for all ICP Controllers. In order to obtain the best performance of the ICP Controller under MS-DOS, this driver should be listed in the first line following the HIMEM.SYS device command in the CONFIG.SYS file. When loaded, GDTX000.EXE replaces the BIOS EPROM (the so-called INT13H interface) of the ICP Controller, and also offers a VDS (Virtual DMA Services) interface. This is of particular importance for Windows 3.x. When using GDTX000.EXE please observe the following:

- GDTX000.EXE must be loaded from the first line following the HIMEM.SYS device command in the CONFIG.SYS file. If HIMEM.SYS is not loaded, it must be loaded from the very first line of the CONFIG.SYS file.
- GDTX000.EXE can be loaded in the UMA.
- GDTX000.EXE is needed for an optimal use of Windows 3.x.
- The ICP Controller unfolds its full capacity under MS-DOS or Windows 3.x only when GDTX000.EXE is installed.
- In order to load GDTSETUP under MS-DOS from disk, you need GDTX000.EXE.
- In the CONFIG.SYS file, GDTX000.EXE must be loaded before GDTASPI.EXE.

Below is an example of a CONFIG.SYS file which is essential for the MS-DOS configuration

```
device=c:\windows\himem.sys
device=gdtx000.exe
files=30
buffers=30
stacks=9,256
dos=high,umb
install=\dos\keyb.com GR,,\dos\keyboard.sys
shell=\COMMAND.COM /E:512 /P
device=gdtx000.exe
device=mouse.sys
device=\dos\setver.exe
device=\gdt\gdtaspi.exe
device=\aspi\aswcdnec.sys /D:CD-ROM
lastdrive=h
```

In this example, besides the GDTX000 driver, the GDTXDOS.EXE driver, the GDT ASPI Manager and an ASPI Module for an NEC CD-ROM drive are loaded.

D.4 Expanded Memory Managers

When using Expanded Memory Managers, a certain address area has to be excluded from being controlled by these programs. This area is the GDT Dual Ported Memory address space (sized 16KB). If the ICP Controller is not run with the GDTX000.EXE driver (that is, the driver has not been loaded from the CONFIG.SYS file), the address space of the GDT BIOS must also be excluded (the size of the GDT BIOS is 8KB). If the GDTX000.EXE driver is loaded from the CONFIG.SYS file in a line **before** the Expanded Memory Manager (EMM), it is not necessary to exclude the address space of the GDT BIOS. Unlike ISA or EISA computer systems where the controller's BIOS address space is set manually (through jumpers or the configuration file), PCI computers automatically map the address space of a peripheral PCI device (e.g., the ICP Controller with its BIOS and Dual Ported Memory) to a suitable location during a warm or cold boot. If the system configuration does not change (no new PCI expansion cards are being added etc.), the PCI System BIOS will always map these two spaces to the same addresses. To help you find out where these addresses have been mapped to, the GDT BIOS indicates the physical address locations of the GDT BIOS and the GDT DPMEM during the cold boot (also see chapter B in this manual):

BIOS located at 0x000E0000 - 0x000E1FFF
In this example, the GDT BIOS occupies E000:0000 to E000:1FFF (E000 is the segment address).

DPMEM at 0x000D0000 - 0x000D3FFF
Here the DPMEM starts at D000:0000 and ends at D000:3FFF (D000 is the segment address).

You may also use other utility programs such as *Georg Schnurer's* (*c't magazine*) **CTPCI** program in order to obtain the requested address locations. On this occasion we would like to thank Mr. *Georg Schnurer* and the *c't magazine* for allowing us to use this very helpful utility on our system disks.

Example 1: The Microsoft EMM386.EXE Manager is used. The GDT driver GDTX000.EXE has not been loaded from the CONFIG.SYS:

```
DEVICE=EMM386.EXE  X=D000-D3FF X=E000-E1FF
```

Example 2: The Microsoft EMM386.EXE Manager is used. The GDT driver GDTX000.EXE has been loaded from the CONFIG.SYS:

```
DEVICE=EMM386.EXE  X=D000-D3FF
```

(Note: You may have to add the path for "EMM386.EXE". Other parameters may follow the excluded areas).

D.5 Using Windows 3.x

In order to be able to install Windows 3.x, a fully operational MS-DOS operating system has to be present on the chosen partition. Furthermore, the first entry in the CONFIG.SYS file behind the HIMEM.SYS line has to be:

```
DEVICE=GDTX000.EXE
```

(if necessary, add the correct path name after the "=" symbol and before GDTX000.EXE).

(A) Now install Windows according to the instructions given in the Windows manual. Generally, you start with *Disk 1 - Setup* from which you load the setup program. This Setup program guides you through the entire installation and prompts you to insert further floppy disks.

(B) After the installation is completed, the Setup program will ask you if you want to reset the system. This reset must be performed.

(C) If you change to the directory WINDOWS after the reset and type in WIN<ENTER>, Windows will be loaded. Although thanks to its high computing power, the ICP Controller is just right for disk intensive operating systems such as Windows, it will not show its full capacity yet. The reason for this is that the "communication" between Windows and the ICP Controller is not yet carried out by GDTX000.EXE, but by Windows' SMARTDRV driver.

(D) The steps in this section aim at removing SMARTDRV from the CONFIG.SYS and AUTOEXEC.BAT files, and at adding a few entries to the Windows initialization file SYSTEM.INI. Now, delete those lines from the CONFIG.SYS and AUTOEXEC.BAT files which contain SMARTDRV.EXE (one line in each file) using an editor such as EDIT for instance which is part of MS-DOS 5 and 6, or deactivate these lines by entering REM at their beginning. Then save and exit the files. Next, load the SYSTEM.INI file located in the WINDOWS directory into the editor and look for the entry **[386Enh]**. The following lines have to be inserted after this entry:

```
[386Enh]
EMMExclude=D000-D1FF   (or according GDT DPMEM area)
VirtualHDIrq=off
DMABufferSize=128
```

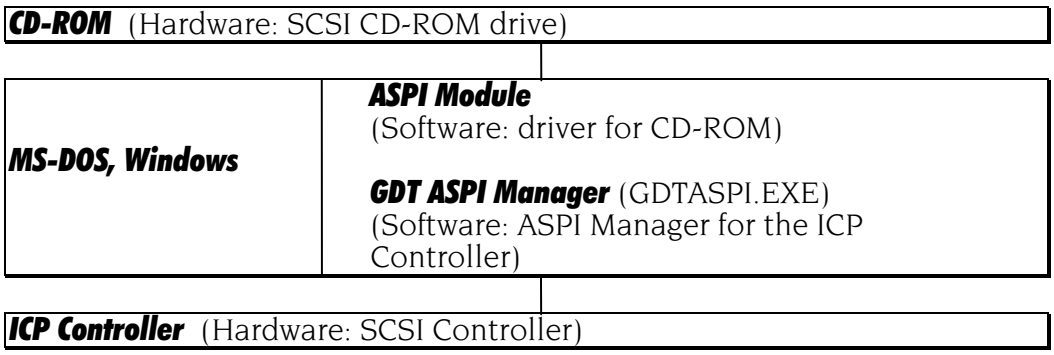
Now save the file. In the line "EMMexclude=..." you have to enter the address area occupied by the GDT DPMEM.

(E) Now do a warm reboot in order for the changes in the CONFIG.SYS the AUTOEXEC.BAT file to take effect.

(F) Now, change to the WINDOWS directory and type in WIN<ENTER>; Windows is loaded again and the installation is completed.

D.6 Using a CD-ROM Drive under MS-DOS or Windows 3.x

CD-ROM drives (as well as tape streamers, WORM drives and most MOD drives, too) belong to the category of the so-called ***Not Direct Access Devices***. They **cannot** be installed with GDTSETUP or FDISK and FORMAT and they are not directly supported by MS-DOS or Windows - unlike, for example, hard disks and removable hard disks. To install and access these devices, a special standard, the so-called ASPI Standard (Advanced SCSI programming Interface), has been created. While the manufacturer of the controller (in this case ICP) has to offer the ASPI Manager, the manufacturer of the SCSI device (CD-ROMs etc.) has to provide an ASPI Module (note: there are some companies which have specialized in the development of ASPI modules, for example Corel Corp. with its product **corelSCSI**; the ICP Controller is certified by Corel). Both units, the SCSI controller and the SCSI device, communicate through this ASPI interface. It is not a hardware interface (like, for example, Centronics, SCSI or RS232), but a pure software interface.
The following illustration explains this interface:


CD-ROM (Hardware: SCSI CD-ROM drive)
MS-DOS, Windows
ASPI Module
(Software: driver for CD-ROM)
GDT ASPI Manager (GDTASPI.EXE)
(Software: ASPI Manager for the ICP Controller)
ICP Controller (Hardware: SCSI Controller)

With the following two examples we demonstrate how to install a CD-ROM drive for use with the ICP Controller under MS-DOS and Windows. The installation differs slightly, depending on whether you use the corelSCSI software or the ASW software. Regardless of which software you choose to use, the ASPI manager of the ICP Controller (located on the GDT S*ystem* D*isk* - DOS) has to be loaded from the CONFIG.SYS file. The objective of both installations is to make the CD-ROM drive accessible as a drive (for example drive E) under MS-DOS or Windows, and to be able to access this drive just as if it were a (write-protected) floppy disk in drive A or B.
At this point we presume that the CD-ROM drive has been properly connected to the ICP Controller. This includes that the SCSI-ID and the SCSI bus terminators are set in accordance with the settings of the already existing SCSI devices (i. e., the SCSI-ID chosen for the CD-ROM drive is not occupied by another device; resistor terminators are located only at the two ends of the SCSI bus).

D.6.1 Example: Using the ASW Software for the CD-ROM

The important lines in both files are printed bold.

CONFIG.SYS

```
device=c:\windows\himem.sys
device=gdtx000.exe
files=30
buffers=30
stacks=9,256
dos=high,umb
shell=\COMMAND.COM /E:512 /P
device=\dos\setver.exe
device=\gdt\gdtaspi.exe
device=\aspi\aspicd.sys /D:CD-ROM
lastdrive=h
```

AUTOEXEC.BAT

```
path=c:\;c:\dos;c:\gdt;c:\aspi;
prompt $P -$G
doskey
c:\aspi\mscdex /D:CD-ROM
```

The GDTX000.EXE driver is loaded from the first line following the HIMEM.SYS command of the CONFIG.SYS file. Loading the SETVER driver (part of MS-DOS) allows older versions of Microsoft's CD-ROM translation program MSCDEX (loaded from AUTOEXEC.BAT) to run trouble-free with the MS-DOS version currently installed. The next line loads the GDT ASPI Manager GDTASPI.EXE. Next, the ASPICD module for the CD-ROM drive is loaded. The parameter "/D:CD-ROM" has nothing to do with a drive name, it only serves as a recognition

information for MSCDEX. As mentioned before, it is our objective to be able to access the CD-ROM drive with a drive name (i.e. E). Naturally, this drive name has to be "free", and there have to be enough drive names available. For example, the DOS command LASTDRIVE=H would enable the user to use drive names from A to H. In the AUTOEXEC.BAT file, the Microsoft translation program for CD-ROMs (MSCDEX - Microsoft CD-ROM Extension) is loaded. It is not part of MS-DOS (except for version 6). The parameter /D:CD-ROM set here has to be identical to the parameter set after the ASPICD module in the CONFIG.SYS file. After a warm reboot which serves to activate the changes made in the CONFIG.SYS and AUTOEXEC.BAT files, the CD-ROM drive can be accessed as drive E (in our example there are two SCSI hard disks in the PCI computer, and under MS-DOS they are accessed as C and D). Drive E can be accessed under Windows, too, now (the Icon next to "E" indicates that it is a CD-ROM drive).

D.6.2 Example: Using corelSCSI for the CD-ROM

When using the corelSCSI software, the installation is carried out by a program (*install*) so that the changes in the files CONFIG.SYS and AUTOEXEC.BAT mentioned below are, to a large extent, made automatically. Under corelSCSI the SCSI/FAST-SCSI channels of the ICP Controller are available as independent host adapters. The important lines in both files are printed bold.

CONFIG.SYS

```
device=c:\windows\himem.sys
device=gdtx000.exe
files=30
buffers=30
stacks=9,256
dos=high,umb
shell=\COMMAND.COM /E:512 /P
device=\dos\setver.exe
device=\gdt\gdtaspi.exe
device=c:\corel\cuni_asp.sys /ID:6 /HAN:0 /N:1 /D:MSCD000
lastdrive=h
```

AUTOEXEC.BAT

```
path=c:\;c:\dos;c:\gdt;c:\aspi;
prompt $P -$G
c:\corel\corelcdx /M:8 /D:MSCD000
```

The first line following the HIMEM.SYS command of the CONFIG.SYS file loads the GDTX000.EXE. The next line loads the GDT ASPI Manager GDTASPI.EXE. Next, the corel ASPI Module for the CD-ROM drive is loaded. The parameter "/D:MSCD000" has nothing to do with a drive name, it only serves as recognition information for CORELCDX. As mentioned before, it is our objective to be able to access the CD-ROM drive with a drive name (i.e., E). Naturally, this drive name has to be "free", and there has to be enough drive names available. For example, the command LASTDRIVE=H would enable the user to use drive names from A to H under DOS. In the AUTOEXEC.BAT file, the corel translation program for CD-ROMs, CORELCDX, is loaded. The parameter /D:MSCD000 set here has to be identical to the parameter set after the ASPI Module in the CONFIG.SYS file. After a warm reboot which serves to activate the changes made in the CONFIG.SYS and AUTOEXEC.BAT files, the CD-ROM drive can be accessed as drive E (in our example there are two SCSI hard disks in the PCI computer, and under MS-DOS they are accessed as C and D). Drive E can be accessed under Windows, too, now (the Icon next to "E" indicates that it is a CD-ROM drive). Information on the various CD-ROM drives which can be used can be obtained directly from Corel.

D.7 The GDT ASPI Manager GDTASPI.EXE

The GDT ASPI Manager GDTASPI.EXE allows you not only to run N*ot* D*irect* A*ccess* D*evices* (e.g., CD-ROMs, tapes, MODs etc.), but to control hard disks and removable hard disks, too (the so-called D*irect* A*ccess* D*evices*). These devices are then no longer controlled by GDT-SETUP but exclusively by the ASPI interface. The advantage is evident, in particular with regard to removable hard disks (for example SyQuest). When using an appropriate ASPI module to access these removable hard disks, for example ASPIDISK.SYS or UNI_ASP.SYS from Corel, you can exchange the media of these drives under DOS without having to use GDTSETUP. To the ASPI interface, the ICP Controller appears as one host-adapter. If there are more SCSI controllers (even if from various manufacturers) in the system and corresponding ASPI managers have been installed in the CONFIG.SYS file, you can determine a controller's host adapter number by using the GDT program **ASPISCAN.EXE**. In order to exclude that a D*irect* A*ccess* D*evice* is run directly from the ICP Controller, it has to be reserved for the ASPI interface control. To do so, certain parameters have to be specified when the GDT ASPI manager is loaded:

DEVICE=GDTASPI.EXE /R:Hx1Iy1[:Hx2Iy2:Hx3Iy3 ...]

H:	host adapter number
I:	SCSI ID of the SCSI device to be reserved
x1, y1:	host adapter number, SCSI ID of the first SCSI device to be reserved (in decimal form)
x2, y2:	host adapter number, SCSI ID of the second SCSI device to be reserved (in decimal form)

Example: We assume that there is only one ICP Controller in the system. Two *direct access devices*, the SyQuest removable hard disk connected to channel A, ID 2, and the Quantum hard disk connected to channel B, ID 4, have to be reserved for the ASPI manager. The corresponding entry in the CONFIG.SYS is:

DEVICE=GDTASPI.EXE /R:H0I2:H1I4

Important note: SCSI devices reserved for the ASPI manager must not have been initialized with GDTSETUP. Neither must they pertain to a GDT Logical or Host Drive. If necessary, these devices can be de-initialized with GDTSETUP.
As already mentioned in paragraph 6 of this chapter, in addition to the ASPI manager an ASPI module has to be present in order to be able to access the SCSI device under MS-DOS with a drive name (e.g., D, E, etc.). In the following description you find how to install ASPI interface-reserved *direct access devices* with the ASW ASPI module ASPIDISK.SYS and the corelSCSI ASPI module UNI_ASP.SYS.

D.7.1 Using ASW ASPIDISK.SYS

***Step* 1:** Include GDTX0000.EXE, GDTASPI.EXE with appropriate reservations (../R:..), and ASPIDISK.SYS in the CONFIG.SYS file, then do a warm reboot (Ctrl+Alt+Del).
***Step* 2:** Use the ASW program AFDISK.EXE to initialize the drive to be run through the ASPI interface.
Step 3: After the successful initialization, do a warm reboot (Ctrl+Alt+Del).
The CONFIG.SYS will be similar to the following (the relevant entries are printed bold):

device=gdtx000.exe
files=30
buffers=30
stacks=9,256

```
shell=\COMMAND.COM /E:512 /P
device=\gdt\gdtxdos.exe
device=\gdt\gdtaspi.exe /R:H1I4
device=aspidisk.sys
```

Note: Drives run with ASPIDISK.SYS are not compatible with drives run with GDTSETUP.

D.7.2 Using corelSCSI

Step 1: Include GDTX0000.EXE, GDTASPI.EXE with appropriate reservations (../R:...) in the CONFIG.SYS file, then do a warm reboot (Ctrl+Alt+Del).
Step 2: Load corel's I*nstall* program and follow the instructions. Preferably, use E*xpress-Setup*.
Step 3: After the successful installation, do a warm reboot (Ctrl+Alt+Del).
Step 4: Using the corelSCSI program CFORMAT, format the drive to be run through the ASPI interface.

The CONFIG.SYS will be similar to the file below (the relevant entries are printed bold). The parameters following the corelSCSI driver refer to a particular configuration, they have automatically been added by the corelSCSI INSTALL program.

```
device=gdtx000.exe
files=30
buffers=30
stacks=9,256
shell=\COMMAND.COM /E:512 /P
device=\gdt\gdtxdos.exe
device=\gdt\gdtaspi.exe /R:H1I4
device=\coreldrv\UNI_ASP.SYS /C:4 /ID:4;;;1 /VOL:1 /DOS4 /SS:512 /@4:-98
```

Note: Drives run with corelSCSI and the UNI_ASP.SYS driver are neither compatible with drives run with GDTSETUP and the GDT cache nor with those run with the above mentioned ASPIDISK.SYS driver.

D.8 Installing Windows 95

This guide will take you through the process to install the files necessary to allow the controller to operate under Windows 95.
We differentiate three cases: The ICP controller is the primary controller, the ICP controller is the secondary controller, and the ICP controller is already installed under Windows 95 and its driver should be updated.

D.8.1 The ICP controller is the primary controller

You must create an **MS-DOS partition** on and **format** the drive to which Windows 95 is to be installed. You also need a **CD-ROM** that is fully accessible under MS-DOS.

1. Transfer the WIN95 files from the **ICP System CD** to a 3.5" floppy disk. The files are located in the directory, (your CD-ROM drive letter):\DRIVERS\WIN95. You will need this disk later in the Windows 95 Setup.

2. Power-on the system. Press **Ctrl+G** to enter the **GDTSETUP** program.

3. Select the controller - **<ENTER>**. Press **F2** to enter **Advanced Setup**.

4. Highlight **Configure Controller** - **<ENTER>**. Highlight **Controller Settings** - **<ENTER>**.

5. Highlight **Delayed Write** - **<ENTER>**. Highlight **OFF** - **<ENTER>**. Delayed write is now disabled. This is done to ensure all files are written immediately to the Host Drive during the Windows installation.

6. Press **Esc**. A message appears: "Do you want to save changes?" Press **<Y>**.

7. Install Windows 95 per instructions provided with the program.

8. After installation: double click **My Computer** icon. Double click the **Control Panel** icon.

9. Double click the **System** icon. Click the **Device Manager** tab.

10. Double click **Other Devices**. Double click **PCI SCSI Bus Controller**.

11. Click **Driver**. Click **Change Driver**. Double click **SCSI Controllers**.

12. Click **Have Disk**. Insert the ICP Windows 95 driver disk you created in step 1.

13. Click **OK**. Click **OK** again. Click **OK** again.

14. Click **Cancel**. **Never click Test. Windows 95 is unable to determine if the ICP BIOS can be removed. Using the Test option may cause the system to freeze.**

15. **Remove** the ICP Windows 95 driver disk. Restart the system.

Upon completion of the Windows 95 installation you will need to load the GDTMON program to Windows 95. The following steps will take you through this process.

1. Find the GDTMON.EXE file in the DRIVERS\WIN95 directory on the ICP System CD.
2. Copy GDTMON.EXE to your Host Drive. Start the GDTMON program.
3. Press **<ENTER>** to select the Controller. Press **<ENTER>** to select the Protocol.
4. Press **<ENTER>** to select the Controller installed.
5. Highlight **View/Change Settings** and press **<ENTER>**.
6. Highlight **Cache Settings** and press **<ENTER>**.
7. Highlight **Delayed Write**. Use the space bar to toggle setting to **ON**.
8. Press **<ENTER>** two times. Delayed Write is now enabled.
9. Highlight **Save Information** and press **<ENTER>**.
10. Type the file name **ICP001** and press **<ENTER>**. *NOTE: This creates a "snapshot" of your system configuration. Anytime the configuration changes (i.e. add a new hard drive, hard drive failure, change system parameters, etc.) save the information again, using the ICP header for the file and the next higher number (i.e. ICP001, ICP002, ICP003, etc.). This information will be needed by ICP Technical Support personnel to assist you in troubleshooting problems with the controller.
11. Press **Esc** two times to exit the GDTMON program.

D.8.2 The ICP controller is the secondary controller

1. Transfer the WIN95 files from the **ICP System CD** to a 3.5" floppy disk. The files are located in the directory, (your CD-ROM drive letter):\DRIVERS\WIN95. You will need this disk later in the Windows 95 Setup.
2. In Windows 95 double click on **My Computer** icon. Double click **Control Panel** icon.
3. Double click the **System** icon. Click the **Device Manager** tab.
4. Double click **Other Devices**. Double click **PCI SCSI Bus Controller**.
5. Click **Driver**. Click **Change Driver**. Double click **SCSI Controllers**.
6. Click **Have Disk**. Insert the ICP Windows 95 driver disk you created in step 1.
7. Click **OK**. Click **OK** again. Click **OK** again.
8. Click **Cancel**. **Never click Test. Windows 95 is unable to determine if the ICP BIOS can be removed. Using the Test option may cause the system to freeze.**
12. Remove the ICP Windows 95 driver disk. Restart the system.

D.8.3 Update the ICP Windows 95 Driver

1. Download the **WIN95.EXE** file from the ICP web site (**http://www.icp-vortex.com**). This self-extracting file contains all the Windows 95 files you need.
2. Run **WIN95.EXE** to get the update files.
3. Format a 3.5" HD disk (1.44MB). **Copy** all Windows 95 files to this disk.
4. In Windows 95 double click on **My Computer** icon. Double click **Control Panel**.
5. Double click **System** icon. Click **Device Manager** tab.
6. Double click **SCSI controller** icon. Double click the **ICP Controller** shown.
7. Click **Driver** tab. Click **Change Driver**.
8. Click **Have Disk**. Insert the Windows 95 driver disk created in step 3.
9. Click **OK** until you reach a prompt to specify the location of the update files.
10. Select the drive where the update disk is located. Click **OK**.
11. When file copy is done, remove the update disk and click Yes.
12. After installation of the new driver, the system needs to **reboot** before the new settings will take effect.

Chapter E

Using NetWare

Intelligent Computer Peripherals ®

ICP

E. Using Novell NetWare

After having explained in chapters B and C the installation of the ICP Controller as well as that of the host-drives, we would now like to give you some hints and pieces of advice on how to install Novell's operating system Novell NetWare. We shall mainly focus on NetWare 3.x and NetWare 4.x. For successful installation, it is essential to study the NetWare system manuals thoroughly. The information given in this chapter refers to the loading of the GDT NetWare driver only.

E.1 Transparency of Host Drives

The structure of the Host Drives, which have been installed with GDTSETUP (in chapter C), is not known to NetWare. I.e., the operating system does not recognize that a given Host Drive consists of a number of hard disks forming a disk array. To NetWare, this Host Drive simply appears as one single hard disk with the capacity of the disk array. This complete transparency represents the easiest way to operate disk arrays under NetWare; neither NetWare nor the PCI computer need to be involved in the administration of these complex disk array configurations.

E.2 Novell NetWare 3.10, 3.11 and 3.12

The ICP Controller and the Host Drives previously configured with GDTSETUP are integrated by means of GDT's driver software located on the GDT N*ovell* N*etWare* disk. The driver belongs to the category of so-called NLMs (NetWare Loadable Module).

GDTRP310.DSK	for NetWare 3.10
GDTRP311.DSK	for NetWare 3.11
GDTRP312.DSK	for NetWare 3.12
ASPITRAN.DSK	ASPI manager
CTRLTRAN.DSK	Module for GDTMON

(Note: More information about the GDTMON diagnosis tool can be found in a separate chapter of this manual.). The installation of the fileserver itself is carried out following the Novell NetWare documentation. According to your NetWare version, copy the appropriate driver, the GDT ASPI Manager ASPITRAN.DSK and the GDT CTRLTRAN.DSK module to the boot disk or the DOS boot partition. During installation type in,

:LOAD GDTRP310 <ENTER>	(NetWare 3.10)	or
:LOAD GDTRP311 <ENTER>	(NetWare 3.11)	or
:LOAD GDTRP312 <ENTER>	(NetWare 3.12)	

The GDT ASPI Manager ASPITRAN.DSK and the CTRLTRAN.DSK module will then be automatically loaded by the GDT driver (GDTRP310, GDTRP311 or GDTRP312). If more ICP Controllers are installed in the fileserver (i.e., for controller duplexing), the above mentioned driver has to be called upon several times. But as it is re-entrant, it is only loaded once. A single ICP Controller can be chosen by selecting its PCI slot number.

E.3 Novell NetWare 4.x

The ICP Controller and the Host Drives previously configured with GDTSETUP are integrated by means of GDT's driver software located on the GDT N*ovell* N*etWare* disk. The driver belongs to the category of the so-called NLMs (NetWare Loadable Module).

GDTRP400.DSK	for NetWare 4.x
ASPITRAN.DSK	ASPI manager
CTRLTRAN.DSK	Module for GDTMON

(Note: More information about the GDTMON diagnosis tool may be found in a separate chapter in this manual.)

The official release for ICP HAM-drivers is scheduled for Q4/98. There is already a beta-package available on our Website.

if you wish to install NetWare 4.x from a CD-ROM, you first have to set up the CD-ROM drive under MS-DOS, following the instructions given in chapter D, section D.6. Then install NetWare following the instructions in the NetWare documentation. During the installation, the NetWare installation program asks you which hard disk driver you want to load, showing a list of available drivers. As the GDT driver is not part of this list yet, you have to boot it from the floppy disk: insert the GDT N*ovell* N*et*W*are* disk into the floppy drive. Now, select the drivers GDTRP400, ASPITRAN and CTRLTRAN. Complete the installation according to the instructions given by the NetWare installation program.
Naturally you can also load the GDT driver directly from the system console, just as with NetWare 3.x:

:LOAD GDTRP400 <ENTER>

(ASPITRAN.DSK and CTRLTRAN.DSK will be loaded automatically). If more ICP Controllers are installed in the fileserver (i.e., for controller duplexing), the above mentioned driver has to be called upon several times. But as it is re-entrant, it is only loaded once. A single ICP Controller can be chosen by selecting its PCI slot number.

E.4 Tips and Tricks

E.4.1 Optimize Data Throughput

High performance RAID controllers are designed for multi-I/O operations and are capable of processing several I/Os simultaneously. Especially cache controllers with powerful on-board RISC CPUs can handle several hundred I/Os per second. NetWare offers the option of adjusting the number of write I/Os which are loaded on the mass storage subsystem. In order to gain optimum performance and speed from modern high performance disk controllers, the amount of the so-called 'maximum concurrent disk cache writes' has been increased with every further development of NetWare. Looking back to NetWare 3.11, only 100 'concurrent disk cache writes' were possible. With NetWare 4.10, this can be as much as 1000.
The number of concurrent disk cache writes delivering the best performance is highly dependent on the performance of the installed disk controller, the amount of cache RAM on the controller and the hard disks. The ICP Controllers can easily cope with up to 500 simultaneous requests. The following command line enables the adjustment of a new number under NetWare (default value = 50):

set maximum concurrent disk cache writes = xxxx

where xxxx represents the required number of concurrent disk cache writes.

E.4.2 'cache memory allocator out of available memory' in PCI-ISA Sy s-tems

PCI-Systems which are not equipped with an EISA-Bus behave in the same way as an ISA mainboard with regard to the available RAM memory. NetWare therefore does not automatically recognize the available memory above 16 MByte. The command 'Register Memory' allows the registration of memory above 16 MByte.
Memory shortage can appear while loading several applications simultaneously on the server, especially where large volumes are concerned. This is because the Register Memory Command is normally carried out in the autoexec.ncf file. This is usually located in the SYS-Volume.
An autoexec.ncf file placed in the DOS-Partition of the NetWare Server helps to get around this problem. In order to carry out this process, the disk driver has to be removed from the startup.ncf and inserted into the autoexec.ncf in the DOS partition. In this case, the disk driver has to be loaded directly after the Register Memory command. An example of an autoexec.ncf file:

register memory 1000000 1000000
LOAD C:GDTRP312
....
In addition, a further start file can be loaded on the SYS volume for differentiation, e.g., with the name 'autonet.ncf'.

E.4.3 Installing NetWare 4.1 - Wrong Drive Name

The following problem often occurs when installing NetWare 4.1 server: While copying the module cdrom.nlm the system hangs - forever. This problem only occurs when the CD-ROM drive's name under MS-DOS is 'cdrom', i.e., the config.sys/autoexec.bat contains the following files:

DEVICE=aspicd.sys /D:cdrom
and
mscdex /D:cdrom

To avoid this problem, simply change the CDROM's name in DOS to another name, i.e., use '/D:scsicd' instead of '/D:cdrom'.

E.4.4 NetWare-Server Not Stable When High Utilization

High server utilization, combined with a large number of applications running on the server often leads to the following problem: The number of 'Dirty Cache Buffers' increases tremendously and the server is then not stable. In order to avoid this situation, the following parameters should be modified:

1. Increase the number of concurrent disk cache writes for the disk subsystem:

set maximum concurrent disk cache writes

This parameter can be increased up to 500 for high performance controllers and fast hard disks.

2. Decrease the delayed write standard parameter:

set dirty disk cache delay time

This parameter sets the time whereafter 'dirty buffers' are written (flushed) from the cache of NetWare to the hard disk. The minimum value is 0.8 seconds which influences the server performance substantially. Therefore, care should be taken not to go below 0.8 seconds.

E.4.5 ICP Controller and Non-ASPI Compatible Controllers

If an ICP Controller is operated under NetWare together with a further controller / hostadapter which does not support the ASPI standard, SCSI Raw Devices cannot be operated on both controllers (tapes, CD-ROMs).
In general, NetWare gives preference to controllers which support the ASPI Standard (GDT, Adaptec). As soon as ASPITRAN.DSK is loaded (Auto-Loading Module) tapes and CD-ROMs on the ASPI non-compatible controller are no longer recognized.
To avoid this problem, the file ASPITRAN.DSK can be deactivated via a modification.
Please note: After this modification, no other Raw Devices (tapes, CD-ROMs) are recognized on the GDT (Adaptec,...).
In order to deactivate ASPITRAN.DSK, the string 'ASPI_Entry' has to be found by using a Disk-Monitor in ASPITRAN.DSK (please pay attention to capitals etc). This string is then modified, e.g., by replacing 'A' with an 'X' (i.e., 'XSPI_Entry').
This modified ASPITRAN.DSK enables the operation of Raw Devices on the non-ASPI-compatible Controllers.

E.4.6 Last Status Information

All ICP Controllers temporarily store the status information from all hard disks which are connected. This information can be very useful when searching for possible causes of disk failures or interferences. The last status information consists of a hexadecimal, 8 digit number and can be displayed via the GDTMONitor or can be saved in a SAVE INFORMATION ASCII file. The information is temporarily available in the ICP Controller's RAM. Therefore, it is important to check this information before switching off and before carrying out a Reset if a disk failure has occurred, or if interference was present. The last status information is divided into Controller-specific and SCSI-specific messages. The most important Last-Status codes are described in this manual, a more detailed description can be found in the files LASTSTAT.PDF (Adobe Acrobat format) or LASTSTAT.TXT (ASCII format) at the ICP vortex Website (http://www.icp-vortex.com).

E.4.7 Adding Additional Capacity After An Online Capacity Expansion

The additional capacity resulting from an online capacity expansion of an existing Array Drive is introduced to the system as a new Host Drive. In order to be able to make use of the new capacity without having to down the server, type "*scan for new devices*" on the server console to recognize the new capacity. Use I*nstall* to build new partitions and volumes.

E.5 Notes on ARCserve

Please make sure that you always have the latest version of your ARCserve software.
The back-up program ARCserve can be used in connection with the ICP Controller. The communication between the tape device (for example DAT, DLT) and the ICP Controller takes place through the ASPI interface. For this purpose, the GDT ASPI Manager ASPITRAN.DSK is needed. When loading the regular GDT NetWare driver (for example GDTRP311.DSK), the ASPI Manager is automatically loaded, too. During the installation of ARCserve, choose ***Adaptec ASPI Manager*** as interface.

Chapter F

Using Windows NT

Intelligent Computer Peripherals ®

ICP

F. Using Microsoft Windows NT

After having explained the installation of the ICP Controller and the host drives in chapters B and C, we now explain how to install the operating system Microsoft Windows NT. For a successful installation, we recommend that you take a close look at the manuals which came with your Windows NT package.

F.1 Transparency of Host Drives

The structure of the Host Drives, which have been installed with GDTSETUP (in chapter C), is not known to Windows NT. I.e., the operating system does not recognize that a given Host Drive consists of a number of hard disks forming a disk array. To Windows NT, this Host Drive simply appears as one single hard disk with the capacity of the disk array. This complete transparency represents the easiest way to operate disk arrays under Windows NT; neither Windows NT nor the PCI computer need to be involved in the administration of these complex disk array configurations.

F.2 General Information on Windows NT

Your ICP Controller may be operated in both operating system variants, the Windows NT *Workstation* variant and the Windows NT *Advanced Server* variant. The ICP Controller is integrated into the Windows NT operating system through the GDTX.SYS driver which is the same for both Windows NT variants. Therefore, in this chapter we shall not distinguish between these two variants. All the information refers both to the Workstation and the Advanced Server variant. Note: At the time this manual was printed, Windows NT 3.5, Windows NT 3.51 and Windows NT 4 .0 had been successfully tested.

F.3 Preparing the Installation

The following steps have to be carried out and/or checked before you can begin with the installation of Windows NT.

Step 1: If you want to install Windows NT 3.51 or NT 4.0, skip this step. If you intend to install Windows NT 3.50 on your system, please observe the following: The GDT driver for NT 3.50 is located in the subdirectory DRIVERS of the GDT Windows NT disk. Its name is GDTX350.SYS. This file has to be renamed into GDTX.SYS and copied into the root-directory of the GDT Windows NT disk.

Step 2: When you do a warm boot by simultaneously pressing the CTRL+ALT+DEL keys, some PCI motherboards carry out a hard reset of the PCI bus. As a consequence, all expansion cards and devices that are connected to the PCI bus, including the ICP Controller, are reset. During the installation procedure of Windows NT this anomaly can cause the contents of the GDT cache RAM to be deleted before the data can be written to the disk(s). If this happens, the installation cannot be completed correctly. Such a warm boot automatically takes place after a FAT partition is converted into an NTFS partition at the end of the Windows NT installation procedure. In order to avoid this problem and prevent the risk of data corruption, **it is advisable to disable the *Delayed Write* function of the GDT cache during complete installation**. To do so, use the GDTSETUP program, choose *Advanced Setup*, *Configure Controller*, *Controller Settings* and switch the *Delayed Write* function OFF. After having completed the Windows NT installation, switch the Delayed Write function ON again.

GDTSETUP -- Version 3.04D - Apr 02 1998
(C) Copyright 1997-98 ICP vortex Computersysteme GmbH
Advanced S
Configure Contro
Co Configure Co
Co Controller Se
Co Firmware Upda
Co Intelligent F
Sa Advanced Sett
Controller Settings
Cache ..... (Off)
Delayed Write ..... (On)
BIOS ..... (Enabled)
BIOS Warning Level ..... (Fatal errors)
Supported BIOS Drives ..... (2)
Memory Test ..... (Standard)
Chn. SCSI-A: Termination ... (Auto)
SCSI-ID ..... (7)
[PCI 0/13]: GDT6519RD, RAM: 16 MB EDO, FW: 2.21.00-RFFF

Step 3: The size of a Windows NT boot partition is limited to a maximum capacity of 2GB (this is a Windows NT restriction).

Step 4: In some cases Windows NT checks the virtual geometric parameters (heads, sectors) of the ICP Controller BIOS Host Drives during the installation process. This can cause Windows NT to calculate wrong parameters. In this case, the first part of the installation procedure (text mode) seems to work fine, but after the first warm boot the installation terminates irregularly because the Windows NT boot loader is no longer available.
To avoid this problem (which will inevitably occur with Host Drives larger than or equal to 1GB), we recommend that you first re-create the so-called *master boot record* (MBR) of the given Host Drive, and secondly, to prepare the Host Drive with a little program named NTPREP for the Windows NT installation. NTPREP.EXE is part of the GDT Windows NT disk.

FDISK /MBR <ENTER> and NTPREP <ENTER>

GDTSETUP includes an option that makes both, FDISK /MBR and NTPREP.
Select the *Configure Host Drives* menu and then *Overwr. Master Boot Code*.

You should never use *Overwr. Master Boot Code* or FDISK /MBR and NTRPEP when the Host Drives already contain valid data.

GDTSETUP -- Version 3.00D - Oct 02 1997
(C) Copyright 1997 ICP vortex Computersysteme GmbH
Host Drive
Change Drive Name
Swap Host Drives
Remove Host Drive
Split Host Drive
Merge Host Driv
Partition Drive
Overwr. Master Boot Code
Do you really want to
overwrite the Master Boot Code ? (Y/N)
elongs to
ogical 0
e Information, F10: Refresh
[PCI 0/9]: GDT6537RP, RAM: 16 MB EDO, FW: 2.19.00-R009

Step 5: When connecting the various SCSI devices to the SCSI channel of the ICP Controller, please ensure that the SCSI-ID of all N*ot-Direct-Access* devices (e.g., CD-ROM, DAT-Streamer, MO-drive, etc.) are adjusted to a value greater than or equal to 2. This applies as well for the CD-ROM drive from which Windows NT is installed.

F.4 The Installation

First of all, make sure that you have verified or carried out all steps described in section F.3.

F.4.1 The ICP Controller is the only Controller in the System

The following instructions 1.) to 12.) assume that the ICP Controller is the only controller in the system and that the operating system is booted from its first Host Drive.

1. Insert the first Windows NT setup disk (Disk #1) into the boot floppy disk drive and reset the system. After a while you are asked to insert Disk #2.
2. Select: ***S=Skip Detection***
3. Select: ***S=Specify Additional Device***
4. Choose ***Other (Requires disk provided by hardware manufacturer)*** and press <ENTER>
5. Insert the GDT W*indows* NT D*isk*.
6. Select the ***GDT SCSI Disk Array Controller*** and press <ENTER>.
7. Setup tells you that it has recognized the ICP Controller. Press <ENTER> to continue.
8. Insert Disk #3 and press <ENTER>.
9. Now you can adjust the other system configuration parameters of your Windows NT system (graphics adapter, mouse, etc.).

10. Afterwards, the installation program scans the system for existing hard disks (which are identical to the Host Drives of the GDT). Choose the drive on which to install Windows NT and which you want to partition.

11. Now the actual installation of the Windows NT operating system begins. Follow the instructions of the Windows NT installation program.

12. After successful installation, switch the *Delayed Write* function of the ICP Controller ON again by using the GDTSETUP program or the GDTMON program.

F.4.2 The ICP Controller is the Secondary Controller in the System

If you wish to use the ICP Controller as a secondary controller in your Windows NT system (e.g. Windows NT is installed on an IDE hard disk), follow the instructions a.) to h.) below:

a) Double click the ***My Computer*** icon.

b) Double click ***Control Panel***.

c) Double click ***SCSI Adapters***..

d) Click on ***Drivers***.

e) Click on ***Add***.

f) Click on ***Have Disk***.

g) Insert the GDT Windows NT driver disk and click ***OK***.

h) Select ***GDT SCSI Disk Array Controller***.

At the next system boot the GDT driver is loaded and the existing Host Drives are ready to be partitioned under Windows NT.

F.4.3 Using the Hot Plug Function with RAID Host Drives

In order to be able to use the Hot Plug function under Windows NT, it is necessary to load GDTMON, the monitoring utility program. (Note: GDTMON.EXE is part of the GDT Windows NT Disk).

F.4.4 Installation of a new GDTX.SYS Driver Version

If it should become necessary to install a new version of the GDTX.SYS driver, the procedure is as follows:

a) Double click the ***My Computer*** icon.

b) Double click ***Control Panel***.

c) Double click ***SCSI Adapters***.

d) Click on ***Drivers***.

e) Select ***GDT SCSI Disk Array Controller***.

f) Click on ***Add***.

g) Click on ***OK***.
Windows NT informs you that this driver is already on the system and asks if you want to use the currently installed driver or a new one.

h) Click on ***New*** and insert the GDT Windows NT driver disk.

i) Click on ***Continue*** and NT copies the new driver to the disk.

At the next system boot the GDT driver is loaded.

F.5 Installation of a Removable Hard Disk

Removable hard disks (e.g., SyQuest, IOMEGA or magneto optical devices, MODs) are controlled by the ICP Controller in two fundamentally different modes:
Mode 1: The removable hard disk is treated like a normal hard disk. The data passes through the cache of the ICP Controller and the media needs to be initialized with GDTSETUP.
Mode 2: The removable hard disk is handled as a *Raw Device*. This means that the removable device is directly controlled by Windows NT without any further interaction of the controller. Consequently, the data is not cached by the GDT cache and the media does not need to be initialized with GDTSETUP. The advantage of mode 1 lies in a decisively better performance due to caching. On the other hand, the relatively complicated procedure of media changing presents a disadvantage. The opposite is true when adopting mode 2: The media change is easy and the media are compatible with other disk controllers (e.g., NCR). The performance is rather low since the data cannot be cached on the ICP Controller.
To install a removable hard disk as a Raw Device, the media must not be initialized with GDTSETUP and the device must be set to a SCSI-ID equal to or greater than 2. In addition, the parameters of the GDT driver GDTX.SYS need to be configured differently in the Windows NT *Registry*

HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\gdtx\Parameters\Device

To do so, follow these instructions:

1. Load the Registry Editor ***regedt32.exe*** in ***\...\system32***

2. Select the window ***HKEY_LOCAL_MACHINE on Local Machine***

3. Choose the Key ***gdtx*** in the directory ***SYSTEM\CurrentControlSet\Services*** .

4. Enter by means of Edit, function Add Key, the name ***Parameters*** .
Select ***Parameters*** .

5. Enter by means of Edit, function Add Key, the name ***Device*** .
Select ***Device*** .

6. Enter by means of Edit, function Add Value, the name ***DriverParameter*** .

7. Use data type ***REG_SZ.***
Now enter the parameter string (e.g.): ***/reserve:0,0,4,0*** .
(This string causes the SCSI device connected with ICP Controller 0, SCSI channel 0, SCSI ID 4, LUN 0 to be reserved as a Raw Device. ICP Controller 0 is the ICP Controller which is detected and configured first after switching on your computer system).

8. The reservation of the SCSI device becomes active after completing regedt32, exiting and rebooting the system.

F.6 Tips & Tricks

F.6.1 ICP Controller not Found During Windows NT Installation

We have observed situations where Windows NT can not find the ICP Controller when installing the GDT driver. This problem is usually caused by one of the standard drivers which Windows NT loads automatically during the first installation phase.
If this is the case, we recommend that Windows NT Setup be started again and carried out in the mode 'user defined'. If this process is carried out correctly, the scan for hard disk controllers carried out by Windows NT can then be omitted. Instead of carrying out a scan, the GDT driver will be installed manually immediately. The ICP Controller should then be easily found. If other disk controllers are in the system, they can also be specified manually after the ICP Controller.

F.6.2 Installation and Upgrade of Windows NT 3.5x / 4.x

Windows NT in the latest Versions 3.51 and 4.0 offers various methods for the installation and the upgrade.

Method 1: The corresponding Setup - Disks 1 to 3 are generated and Windows NT (the Upgrade) is installed by booting the disks.
In general, it is recommended to use method 1 for installing Windows NT, as the operating system always enables the user to insert an OEM disk (e.g., the driver disk of the ICP Controllers). In addition, installation is much faster if method 1 is used as not all Windows NT raw files have to be copied to a temporary directory.
Installation according to method 1 affords that 3 setup disks are generated. This is carried out via the program Winnt.exe on the Windows NT CD, i.e., by entering the command line:

WINNT /OX

The switch '/OX' ensures that the Setup disks are generated.

Method 2: Windows NT generates a temporary directory on an existing partition and installs the operating system (i.e., the upgrade) from there.
This installation is only possible if there is already a partition with enough free disk space (around 150 MByte). Depending on whether it is an upgrade or a new installation, either WINNT.EXE has to be started with the corresponding command line option (e.g., 'WINNT /B' during a new installation via a temporary directory on a DOS Partition), or the Upgrade Icon on the CD-ROM symbol of the inserted Windows NT CD-ROM can be clicked on.
In any of these circumstances, Windows NT does not automatically enable the user to be able to insert an OEM disk. With all hard disk controllers, where the driver is not on the Windows NT CD-ROM, the following problem occurs: The access to the hard disk is not possible after the first reboot of the computer during the installation procedure. Normally, the error message 'Inaccessible Boot Device' appears and the installation is stopped.
To avoid this error message, a ' hidden key ' of Windows NT should be used. As soon as the NT operating system has restarted the computer (reset), and the setup program starts, the key F6 has to be pressed and held down when the Setup screen appears. The Setup screen appears before the symbol for the Windows NT-Version and the system RAM is displayed in the upper corner of the screen. This is easily recognizable by a blue background color. In contrast to the 'Boot-Screen' with the version message and RAM message, the setup screen uses the large screen font.
After pressing F6, a window is opened and Windows NT offers the opportunity of specifying an additional device driver. Now insert the floppy disks with the Windows NT driver for the ICP Controller. If the whole process described above has been carried out correctly, a window is displayed in the middle of the screen with the message 'GDT Disk Array Controller'.

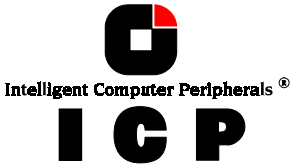
If the function key F6 was not pressed at the correct point, the procedure can be easily repeated by rebooting the computer (hard reset).
Otherwise, Windows NT restarts the driver of the ICP Controllers after confirming by pressing the <ENTER>-key. Installation can be carried out in the usual way. The GDT driver disk will be needed again later to allow Windows NT to copy the gdtx.sys to the boot partition.

F.6.3 Adding Additional Capacity After An Online Capacity Expansion

The additional capacity resulting from an online capacity expansion of an existing Array Drive is introduced to the system as a new Host Drive. In order to be able to make use of the new capacity without having to down the server, use the *Disk Administrator*. When loading, it detects the new Host Drive.

Chapter G

GDTMON



G. The Diagnosis Program GDTMON

GDTMON (GDT monitor) is a helpful and flexible diagnosis tool for the monitoring, maintenance and tuning of mass storage subsystems which are based on one or more ICP Controllers. The key features of GDTMON:

- Diagnosis program with a graphical user interface. Clear performance representation with variable horizontal bars
- Available under MS-DOS, NetWare 3.x & 4.x, Windows 95, Windows NT, OS/2 and SCO UNIX
- Loadable locally (on the server) or remotely from an authorized workstation (NCPE and NETBIOS protocol support)
- Indicates the performance, expressed in [KB/sec] and [IO/sec], of:
  - Host Drives (Disk, Chain, RAID 0, 1, 4, 5, 10)
  - Logical Drives
  - SCSI Drives and FCAL Drives
- Indicates the GDT cache utilization
  - Read-Hits
  - Write-Hits
  - Separate indication for data- and parity-cache (RAID 4/5)
- Allows online changing of the GDT cache parameters:
  - Cache ON/OFF
  - Delayed Write ON/OFF
- Allows online changing of the devices' parameters:
  - SCSI protocol
  - Synchronous or Asynchronous data transfer
  - Setting of the synchronous data transfer rate
  - Disconnect/Reconnect
  - Disk Cache ON/OFF
  - Tagged Queues ON/OFF
- Indicates the structure of Logical, Array and Host Drives
- Performs online parity checking of RAID 4 and RAID 5 Host Drives
- Allows the online RAID Level migration and capacity expansion of existing Array Drives
- Saves all relevant configuration data to floppy disk or hard disk
- Sets up or removes RAID 1 Disk Arrays while maintaining full operational conditions
- Performs Hot Plugs on RAID 4 / RAID 5 disk arrays
- Allows to add or remove a dedicated or pool Hot Fix drive while maintaining full operational conditions

G.1 Loading GDTMON

As mentioned before, the GDTMON program is available for various operating systems. It can be used either locally or remotely. This means that all ICP Controllers in a network can be monitored and serviced from one (or several) workstation(s). The communication between the ICP Controller(s) and the GDTMON program is based on the NETBIOS or NCPE protocols. Thus, for example, it is possible to monitor the ICP Controller in an OS/2 workstation or the ICP Controller in the Novell NetWare fileserver from a Windows 95 workstation.
In order to be able to access a certain computer system with its ICP Controller remotely on the network, a special communication module has to be loaded first, which routes the information through the network. For a Novell NetWare fileserver this is the CTRLSRV.NLM module (NCPE). For Windows NT (server and workstation), Windows 95 and OS/2 (server and workstation) this is the NBSERVx.EXE module (NETBIOS). While the module is loaded it searches for a CTRLSRV.CFG (Novell NetWare) or NBSERV.CFG (Windows NT, Windows 95 and OS/2) file, which includes the definition of the access rights of the different users and their passwords. The CFG file assigns every user to two different access levels. Access level 0 gives the user all functions to view and change the controller-, disk-drive and disk-array-settings. Access level 1 entitles the user only to view the various settings and performance data.
The Windows NT, Windows 95 and OS/2 driver diskettes include so-called DLLs for the supported protocols. Example: If the MON4NETB.DLL file is located in the same directory as GDTMON.EXE file for Windows NT, the NETBIOS protocol is automatically used for the GDTMON on this system. As soon as the NETBIOS support of this operating system is installed during the network configuration, the GDTMON on this system can communicate through this protocol with another system in the network which has a ICP Controller.
The following drivers for the 'remote' GDTMONitor are currently available:

OS/2

GDTMON32.EXE	GDTMONitor for OS/2
MON2NETB.DLL	NETBIOS DLL for OS/2
MON2NCPE.DLL	NCPE DLL for OS/2
NBSRV2.EXE	NETBIOS Server for OS/2
NBSRV.CFG	Configuration file for NetBios Server
NBCLEAN2.EXE	NETBIOS analysis program

Windows NT

GDTMON.EXE	GDTMONitor for Windows NT
MON4NETB.DLL	NETBIOS DLL for Windows NT
NBSRV4.EXE	NETBIOS Server for Windows NT
NBSRV.CFG	Configuration file for NETBIOS Server
NBCLEAN4.EXE	NETBIOS analysis program

Windows 95

GDTMON.EXE	GDTMONitor for Windows 95
MON5NETB.DLL	NETBIOS DLL for Windows 95
NBSRV5.EXE	NETBIOS Server for Windows 95
NBSRV.CFG	Configuration file for NETBIOS Server
NBCLEAN5.EXE	NETBIOS analysis program

The MS-DOS GDTMON also allows remote access. The DLLs are integrated into the GDTMON.EXE file, thus there is no NETBIOS server available for MS-DOS. Since there is no NETBIOS support within MS-DOS, it is necessary to load the NETBIOS program to access from a MS-DOS workstation through the network a ICP Controller in a Windows NT and OS/2 workstation or server, or a Windows 95 workstation. NETBIOS is part of the Novell NetWare operating system. For the remote access of a Novell NetWare fileserver the NETBIOS program is not needed.

G.1.1 Loading the GDTMON Program Under NetWare

The GDTMON program for NetWare is part of the GDT N*ovell* N*etWare* disk.
GDTMON can be used either under NetWare 3.1x or under NetWare 4.x. There are two different methods of loading GDTMON:

- loading GDTMON on the fileserver
- loading GDTMON on an authorized workstation (remote)

Loading GDTMON on the fileserver. Beforehand, the GDT NetWare driver (GDTRP311.DSK for NetWare 3.11, GDTRP312.DSK for NetWare 3.12 and GDTRP400.DSK for NetWare 4.x) and the auto-loading module CTRLTRAN.DSK must have been loaded on the fileserver.

LOAD GDTMON <ENTER>

on the fileserver.

Loading GDTMON on a workstation. In this case, too, the GDT NetWare driver and the auto-loading module CTRLTRAN.DSK must have been previously loaded on the fileserver console. In addition, the module CTRLSRV.NLM has to be loaded. This module searches for a file named CTRLSRV.CFG. This file must be located in the same directory as CTRLSRV.NLM. The system administrator has to set up a user group named GDT_OPERATOR. All users belonging to this group are given access (through GDTMON) to the ICP Controller(s) in this specific fileserver (Access level 0). Now, the GDTMON program can be loaded from one (or more) workstation(s):

GDTMON <ENTER>

By selecting the menu S*elect C*ontroller of the GDTMON main menu, you can now choose either a fileserver (equipped with a ICP Controller), or a ICP Controller in your workstation.

G.1.2 Loading the GDTMON Program Under OS/2

The GDTMON program for OS/2 is part of the GDT OS/2 disk. To load the program under OS/2, enter:

GDTMON32 <ENTER>

G.1.3 Loading the GDTMON Program Under Windows NT

The GDTMON program for Windows NT is part of the GDT W*indows* NT disk. To load the program under Windows NT, enter:

GDTMON <ENTER>

G.1.4 Loading the GDTMON Program Under Windows 95

The GDTMON program for Windows 95 is part of the GDT W*indows* 95 disk. To load the program under Windows 95, enter:

GDTMON <ENTER>

G.1.5 Loading gdtmon under SCO UNIX

In order to be able to use the gdtmon program under SCO UNIX (2.x, 4.x and 5.x), it becomes necessary to substitute the standard terminal entry by a new one:

```
cd /usr/lib/terminfo <ENTER>
tic  gdt386.src <ENTER>
```

Before each loading of gdtmon, this terminal has to be activated by:

```
TERM  =  gdt386 <ENTER>
export   TERM <ENTER>
```

These two lines can also be inserted in the ***.profile*** file and will then be automatically processed during each login. The gdtmon program itself is copied during the SCO UNIX installation (chapter G of this User's Manual) into the */etc* directory. gdtmon is loaded by entering:

```
gdtmon <ENTER>
```

G.2 The GDTMON Program

As mentioned before, the GDTMON program appears identical for all operating systems, so we can demonstrate the use and functioning of this program regardless of the operating system used. In previous chapters we have already described the hierarchical structure of the GDT firmware. We have defined 4 different levels of hierarchy: Level 1 where the physical devices named **P*hysical* Drives** are found, level 2 containing the ***Logical* Drives** (made up of one or several P*hysical* D*rives*), level 3 where we have the ***Array* Drives**, and finally, level 4 where the ***Host* Drives** are. Only the latter ones are known to the operating system. The drive of a given level of hierarchy is always set up by using the drives of the next lower level as components. Accordingly, GDTMON has various menu options, each referring to one level of hierarchy

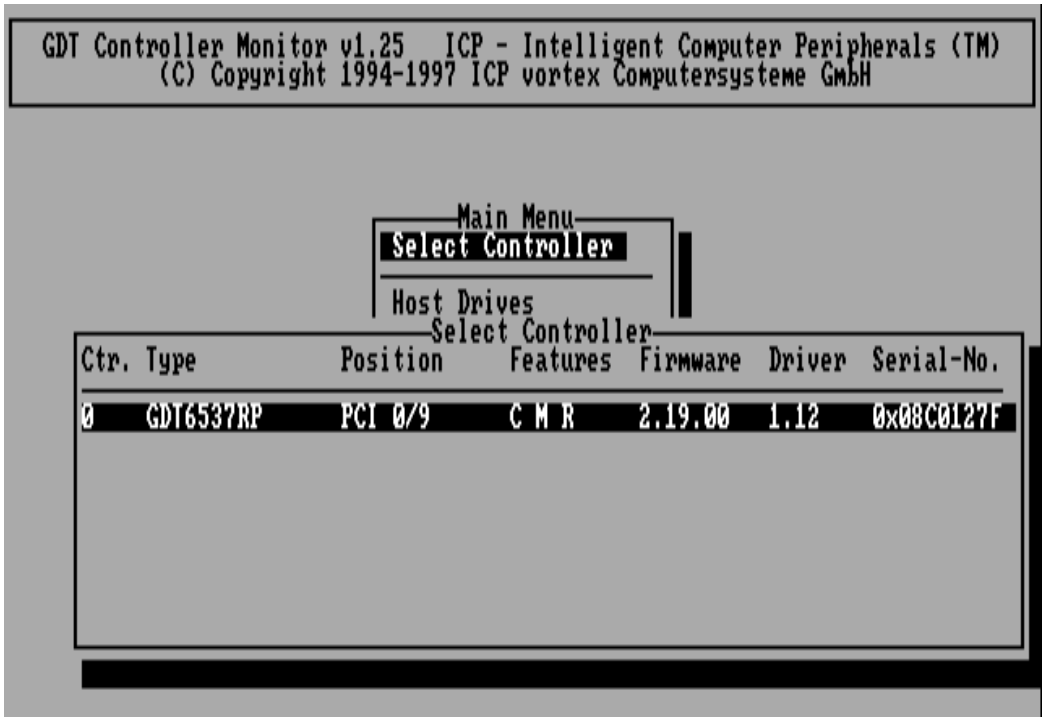
Host Drives	———	Level 4
Logical Drives	———	Level 2
Physical Drives	———	Level 1

Each menu option displays the performance of the drives belonging to the corresponding level. (Note: The performance of Array Drives and Host Drives is identical). The performance is measured in KB/s (kilobyte per second, transfer rate) and IO/s (I/Os per second, number of simultaneously processed I/Os on the ICP Controller). The performance is displayed numerically as well as graphically in the form of variable horizontal bars, with separate indications for each drive and its write and read accesses.

G.2.1 Select Controller

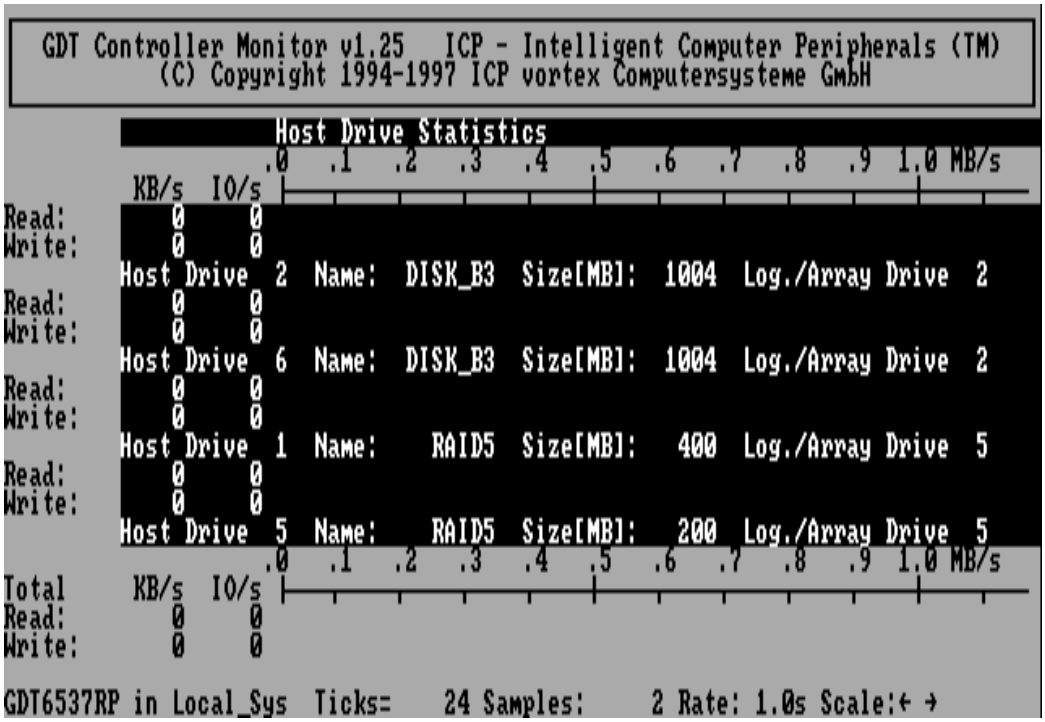
This menu option yields a list of available ICP Controllers. By selecting a protocol, you have either access to the ICP Controller(s) in your local computer (e.g., MS-DOS, Windows NT, Windows 95 or OS/2 protocol), or to a ICP Controller in another computer (server or workstation) in the network (NetWare NCPE or IBM NETBIOS protocol). All diagnosis and maintenance functions of GDTMON refer to the ICP Controller you have selected here (and the hard disks connected with this controller).

(MS-DOS) in the Select Protocol menu indicates that the GDTMON program was loaded on a MS-DOS computer. I.e.: If GDTMON had been loaded under Windows NT, we would see there (Windows NT).


GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
(C) Copyright 1994-1997 ICP vortex Computersysteme GmbH
Main Menu
Select Controller
Host Drives
Select Controller
Ctr. Type Position Features Firmware Driver Serial-No.
0 GDT6537RP PCI 0/9 C M R 2.19.00 1.12 0x08C0127F

G.2.2 Host Drives

This menu option leads to the list of available Host Drives (level 4). We would like to recall that the operating system (e.g., NetWare) only recognizes these Host Drives and not their possibly complex structures. This means that it is of no importance for the operating system if a Host Drive consists of one single hard disk (of the type *disk*), or of 5 hard disks configured to form a RAID 4 Array Drive. Apart from the performance, the name, type, state and capacity (1024KB = 1MB) of a Host Drive is displayed. The figures shown at T*otal* represent the overall performance of the Host Drives as a whole. With the ← and → keys you may change the scale of the graphical KB/s indication. With the ↑ and ↓ keys you can scroll the screen to see further Host Drives (if available).


GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
(C) Copyright 1994-1997 ICP vortex Computersysteme GmbH
Host Drive Statistics
.0 .1 .2 .3 .4 .5 .6 .7 .8 .9 1.0 MB/s
KB/s IO/s
Read: 0 0
Write: 0 0
Host Drive 2 Name: DISK_B3 Size[MB]: 1004 Log./Array Drive 2
Read: 0 0
Write: 0 0
Host Drive 6 Name: DISK_B3 Size[MB]: 1004 Log./Array Drive 2
Read: 0 0
Write: 0 0
Host Drive 1 Name: RAID5 Size[MB]: 400 Log./Array Drive 5
Read: 0 0
Write: 0 0
Host Drive 5 Name: RAID5 Size[MB]: 200 Log./Array Drive 5
.0 .1 .2 .3 .4 .5 .6 .7 .8 .9 1.0 MB/s
Total KB/s IO/s
Read: 0 0
Write: 0 0
GDT6537RP in Local_Sys Ticks= 24 Samples: 2 Rate: 1.0s Scale:+ +

(Note: All Host Drives on the screen shown above are idle.)

G.2.3 Logical Drives

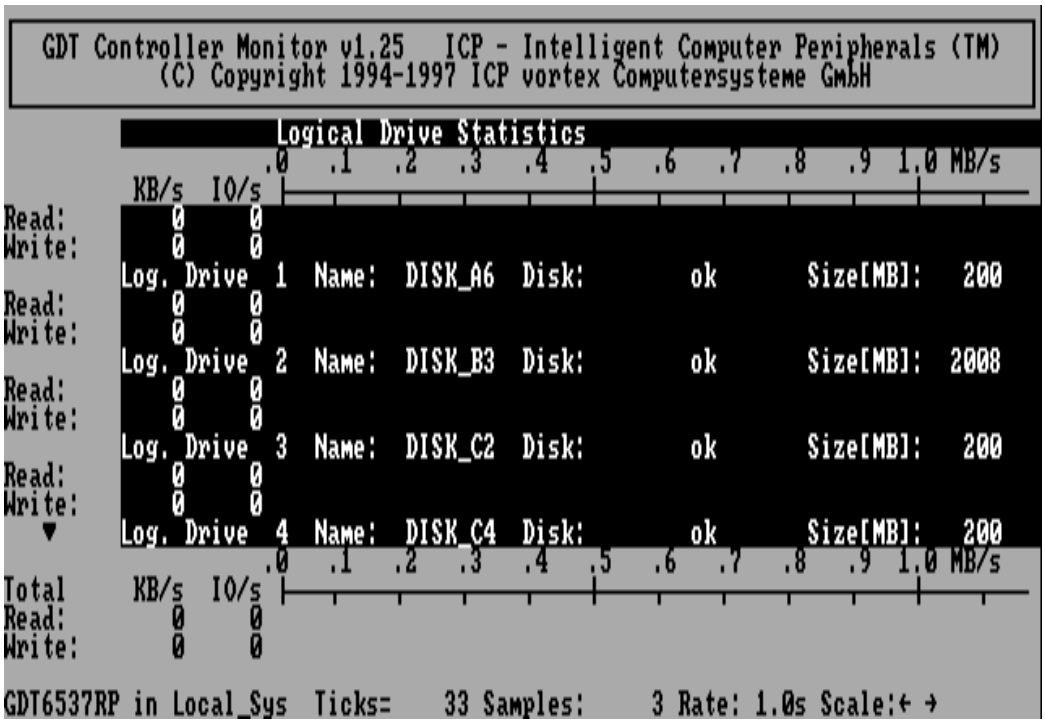
This menu option yields a list of available Logical Drives (level 2). Logical Drives are the components for Array Drives and Host Drives. In its most simple form, a Host Drive consists of one Logical Drive which is made up of a single hard disk (type *disk*). In case of RAID Host Drives, the performance of the Logical Drives forming a RAID Host Drive are shown in the menu *Logical Drives*. The performance data displayed here gives immediate information on the quality of a given Host Drive. When judging the indicated performance of Logical Drives belonging to a RAID Host Drive, the following considerations should be taken into account:

(a) RAID 0, RAID 1, RAID 10 and RAID 5 Host Drives
If a certain Logical Drive shows poor performance for a longer period (when compared to the other Logical Drives), this Logical Drive impairs the overall performance, making it the *bottle neck* of the entire RAID Host Drive.

(b) RAID 4 Host Drives
In principle, the same as in (a) applies to RAID 4 Host Drives, with the exception made for the parity Logical Drive. The poor performance can have various reasons: the hard disk forming the Logical Drive

- is too slow (different from the other hard disks with regard to type or manufacturer)
- has wrong parameters (SCSI II, disk cache, tagged queues etc.)
- has too many defects, causing the read/write actuator to have to move to *alternate tracks* very often

When setting up RAID 4/5 Host Drives, please observe the notes on RAID 4/5 Host Drives exposed in the chapter **GDTSETUP in Detail**.

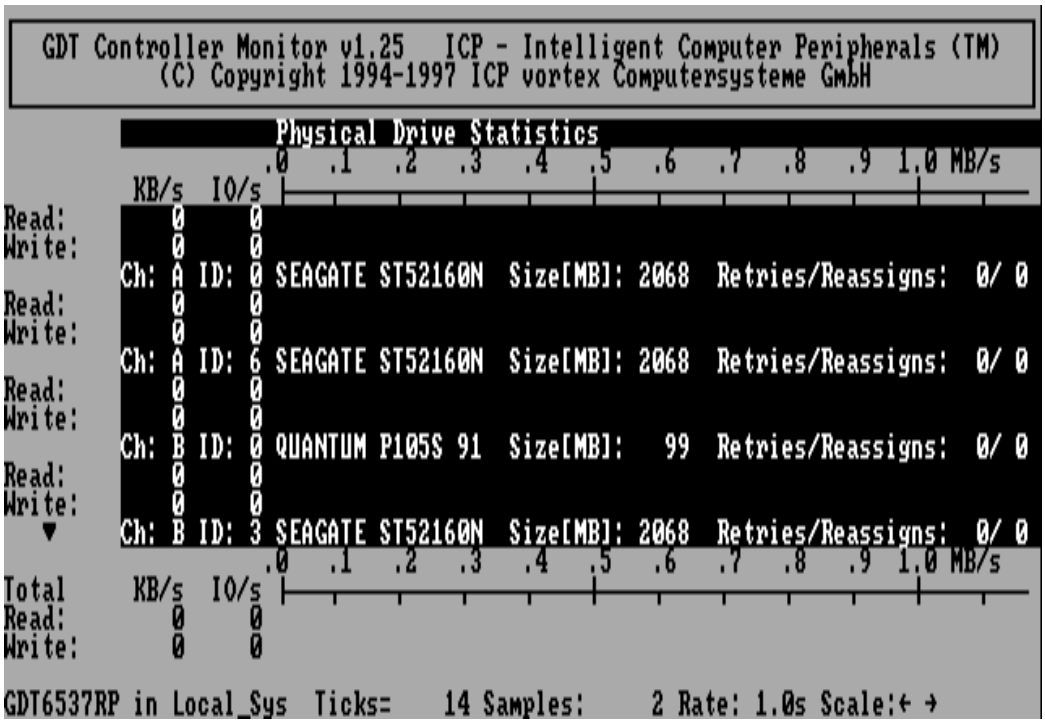

GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
(C) Copyright 1994-1997 ICP vortex Computersysteme GmbH
Logical Drive Statistics
.0 .1 .2 .3 .4 .5 .6 .7 .8 .9 1.0 MB/s
KB/s IO/s
Read: 0 0
Write: 0 0
Log. Drive 1 Name: DISK_A6 Disk: ok Size[MB]: 200
Read: 0 0
Write: 0 0
Log. Drive 2 Name: DISK_B3 Disk: ok Size[MB]: 2008
Read: 0 0
Write: 0 0
Log. Drive 3 Name: DISK_C2 Disk: ok Size[MB]: 200
Read: 0 0
Write: 0 0
Log. Drive 4 Name: DISK_C4 Disk: ok Size[MB]: 200
.0 .1 .2 .3 .4 .5 .6 .7 .8 .9 1.0 MB/s
Total KB/s IO/s
Read: 0 0
Write: 0 0
GDT6537RP in Local_Sys Ticks= 33 Samples: 3 Rate: 1.0s Scale:← →

The figures under T*otal* represent the total performance of all Logical Drives. With the ← and → keys you may change the scale of the graphical KB/s indication. With the ↑ and ↓ keys you can scroll the screen to see more Logical Drives (if available).

G.2.4 Physical Drives

In addition to the performance report on the hard disks, you are given additional information on each device:

- the GDT I/O channel the hard disk is connected to
- which ID the hard disk has
- the name of the hard disk
- the gross capacity (1MB = 1024KB)


GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
(C) Copyright 1994-1997 ICP vortex Computersysteme GmbH
Physical Drive Statistics
.0 .1 .2 .3 .4 .5 .6 .7 .8 .9 1.0 MB/s
KB/s IO/s
Read: 0 0
Write: 0 0
Ch: A ID: 0 SEAGATE ST52160N Size[MB]: 2068 Retries/Reassigns: 0/ 0
Read: 0 0
Write: 0 0
Ch: A ID: 6 SEAGATE ST52160N Size[MB]: 2068 Retries/Reassigns: 0/ 0
Read: 0 0
Write: 0 0
Ch: B ID: 0 QUANTUM P105S 91 Size[MB]: 99 Retries/Reassigns: 0/ 0
Read: 0 0
Write: 0 0
Ch: B ID: 3 SEAGATE ST52160N Size[MB]: 2068 Retries/Reassigns: 0/ 0
.0 .1 .2 .3 .4 .5 .6 .7 .8 .9 1.0 MB/s
Total KB/s IO/s
Read: 0 0
Write: 0 0
GDT6537RP in Local_Sys Ticks= 14 Samples: 2 Rate: 1.0s Scale:

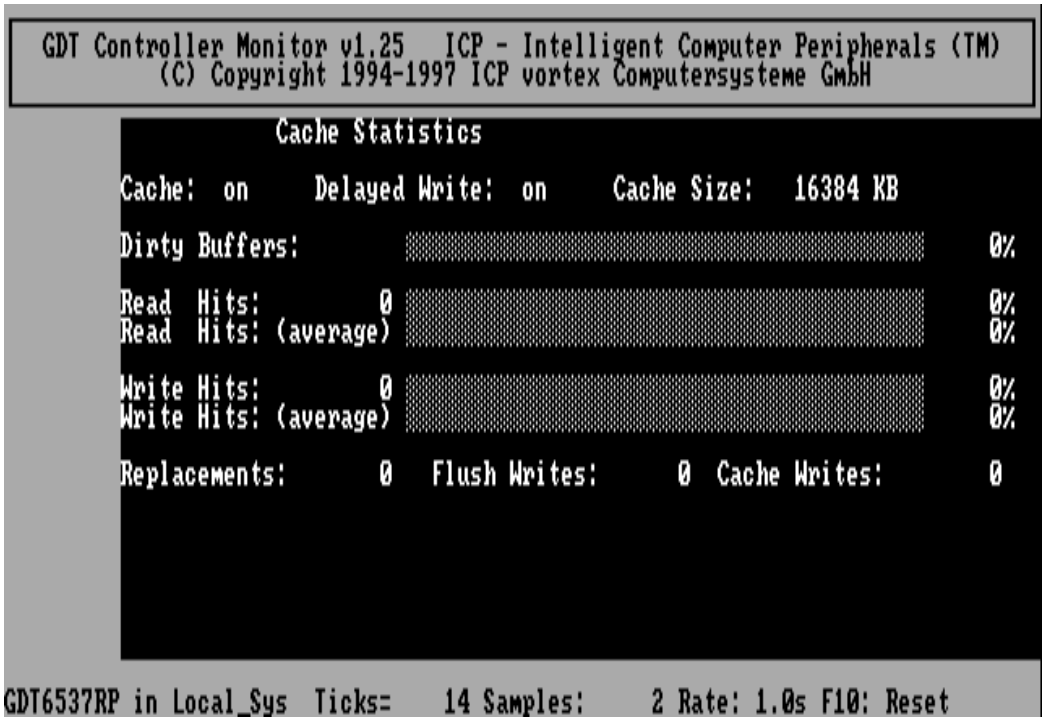
The R*etries*/R*eassigns* counters have a particular meaning:

(1) The R*etries* counter is incremented by one unit whenever the ICP Controller retries to access a hard disk. If this counter continues to increase (possibly on other hard disks, too) it is very likely that the cable is not *good* enough for the selected data transfer rate (cable too long, poor quality of cable and connectors), or that the SCSI bus is not properly terminated (too many terminators on the cable, or missing terminator). In very few cases is the hard disk concerned defective. The retry counter also increases when the SCSI parameters of a hard disk are changed (see further ahead). Obviously, retries due to this do not imply bad cabling.

(2) The reassign counter reflects the number of media defects which occur on the hard disk drive. Defective blocks of the hard disk are assigned substitute blocks (spare blocks) which are either on the same track, or on alternate ones if all spare blocks on the same track are already in use. The administration of the reassignments is carried out by the hard disk through according reassignment tables. Note: If a hard disk works with alternate tracks, it is generally no longer suitable for applications with high performance expectations. Whenever a defective block is being accessed, the read/write actuator has to move to an alternate position and this requires extra time.
If you observe that the number of reassigns is constantly increasing, you may suspect that something is wrong with this drive.
With the ← and → keys, you can change the scale of the graphical KB/s indication.
With the ↑ and ↓ keys, you can scroll the screen to see more hard disks (if available).

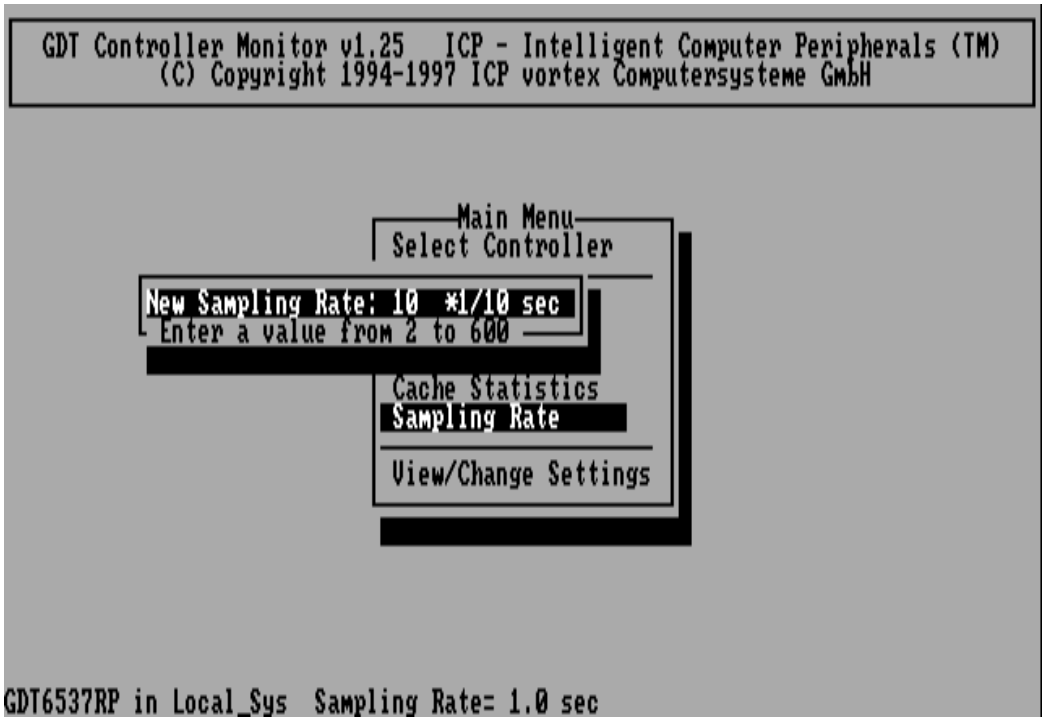
G.2.5 Cache Statistics

This menu option gives information on the utilization of the GDT cache. For RAID 4/5 Host Drives, the data cache and parity cache are displayed separately.
Note: The GDT firmware only allocates cache RAM to the GDT parity cache if RAID4/5 Host Drives have been set up.


GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
(C) Copyright 1994-1997 ICP vortex Computersysteme GmbH
Cache Statistics
Cache: on Delayed Write: on Cache Size: 16384 KB
Dirty Buffers: 0%
Read Hits: 0 0%
Read Hits: (average) 0%
Write Hits: 0 0%
Write Hits: (average) 0%
Replacements: 0 Flush Writes: 0 Cache Writes: 0
GDT6537RP in Local_Sys Ticks= 14 Samples: 2 Rate: 1.0s F10: Reset

G.2.6 Sampling Rate

By setting the sampling rate, you can choose the interval at which the ICP Controller delivers new measurements. According to the operating system used, the sampling rate can be set to a maximum of 60 seconds. The default setting is 1 second.


GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
(C) Copyright 1994-1997 ICP vortex Computersysteme GmbH
Main Menu
Select Controller
New Sampling Rate: 10 *1/10 sec
Enter a value from 2 to 600
Cache Statistics
Sampling Rate
View/Change Settings
GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

G.3 The Menu: View/Change Settings

This menu includes a set of very powerful options and functions for the online maintenance and diagnosis of RAID 1/4/5/10 Host Drives.

From this menu you can select further submenus:

Controller

- View the ICP Controller configuration
- View Last Events
- View/Change the Intelligent Fault Bus settings

Cache Settings	-	View/Change the GDT cache parameters
Physical Drives	-	View/Change the SCSI parameters
Logical Drives	-	Display the structure of Logical Drives - Add/Remove Mirror Drives to/from Host Drives - Perform a Hot Plug on a RAID 1 Host Drive - Add/Remove Private Hot Fix and Pool Hot Fix drives to/from a RAID 1 Host Drive
Array Drives	-	Display the structure of RAID 4/5/10 Host Drives - Perform a Parity Verify on RAID 4/5 Host Drives - Perform a Parity Recalculation on RAID 4/5 Host Drives - Perfrom online capacity expansion and/or RAID level migration - Perform a Hot Plug on RAID 4/5/10 Host Drives - Add/Remove Private Hot Fix and Pool Hot Fix drives to/from RAID 4/5/10 Host Drives
Save Information	-	Save all relevant configuration data to disk

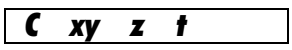
Before going into detail, some information on the so-called Hot Plug of fault tolerant disk arrays (RAID 1/4/5/10) is given below.

G.3.1 Notes and Information on the Hot Plug function of GDTMON

Fault tolerant means that a hard disk which is part of a RAID 1/4/5/10 Array Drive can fail without causing data loss on the Array Drive. At the same time, the Array Drive remains fully accessible. Obviously, the Array Drive then lacks the redundant data, therefore the defective disk should be replaced by an intact one as soon as possible. In chapters C (RAIDYNE Q*uick-Setup*) and L (GDTSETUP *in Detail*), we have shown with various examples how to exchange a defective drive with GDTSETUP. Moreover, we described the functioning of the so-called Hot Fix drive. This "constantly available spare part when needed" automatically integrates itself into the Array Drive and is therefore the quickest means of regaining a redundant Array Drive.
The Hot Plug function enables the replacement of a drive of an Array Drive (either in the *ready* or *fail* state) while the system continues to run, that is, without having to shut down the NetWare fileserver for instance. A drive replacement may not only become necessary when the drive has already failed, but also when there are signs that a failure could occur soon (strong whistling of the hard disk, or constant retries of the read/write head).
Only those users with thorough knowledge of RAID and the ICP Controller should use the Hot Plug function. Improper use can lead to data loss. (Naturally, we have integrated all kinds of security provisions into the ICP Controller and GDTMON. But how can we prevent a user from plugging out the wrong drive?). We recommend that you document each Array Drive immediately after its configuration with GDTSETUP. This record should at least comprise the following information:

- To which ICP Controller has the Array Drive been connected ?
- Which hard disks are part of the Array Drive ?
- To which SCSI ID have they been set ?
- Which SCSI devices terminate a SCSI channel ?

In addition, the hard disks themselves should be labeled with the above information. The following is an example of such a label.



C: controller number ***x***: channel
y: ID ***z***: Logical Drive number
t: **+** = terminated, **-** = not terminated (with SCSI hard disks)

Example:

1 SCSI-A 6 3 +

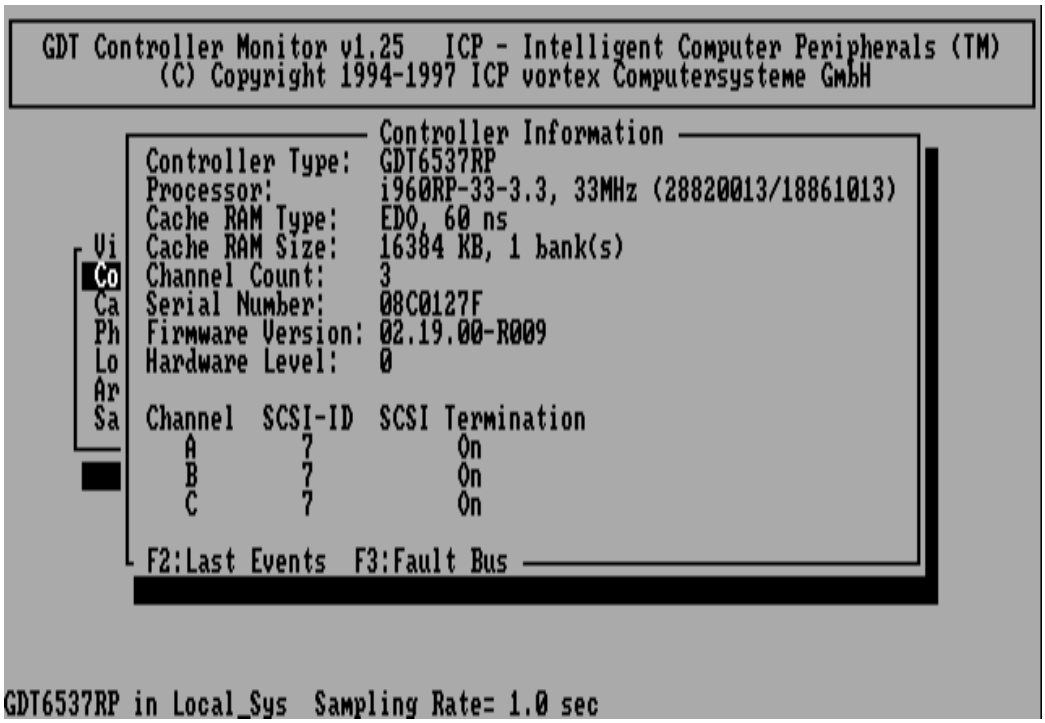
controller number 1, SCSI channel A, SCSI-ID 6, Logical Drive number 3, terminated. The menu option S*ave I*nformation of GDTSETUP, GDTMON program can be of help when setting up the documentation.

How does the* Hot Plug *mechanism work ?

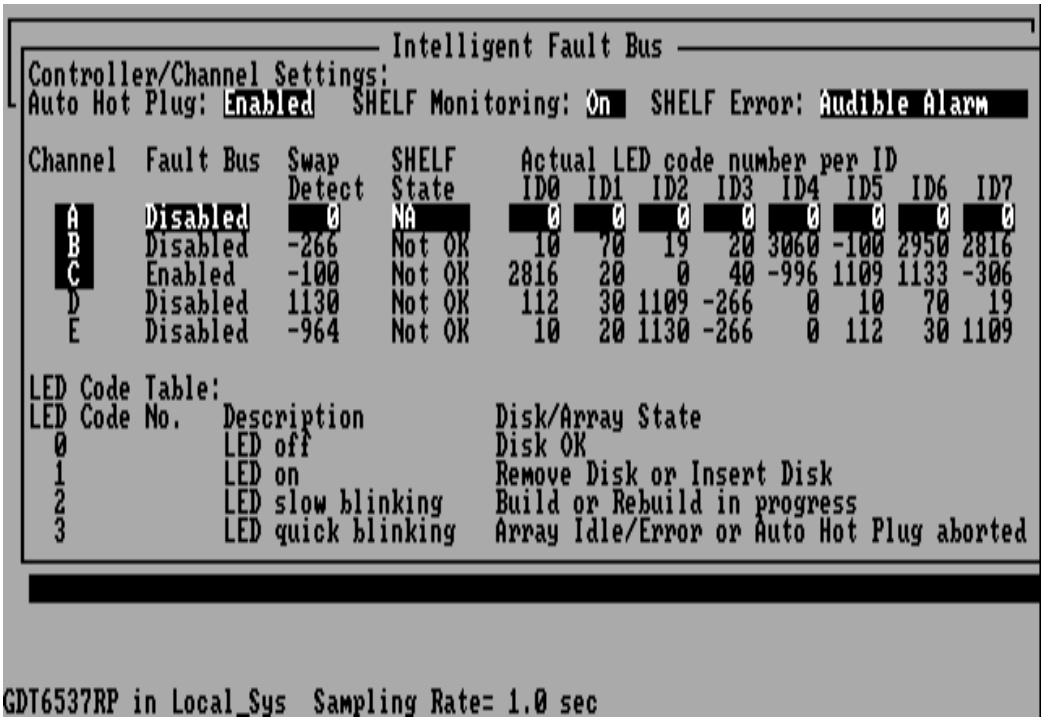
During the Hot Plug, the I/O channel of the ICP Controller to which the drive to be exchanged is connected, is temporarily "halted" (for the time needed for the exchange), so that the drive can be disconnected from the I/O channel and replaced without any risk. After the replacement, the I/O channel halt is lifted and the firmware automatically begins to rebuild the new drive. The halting and the halt-lifting of the I/O channel is controlled by the Hot Plug function. The Hot Plug should be carried out as quick as possible.

G.3.2 Controller

This option displays details on the ICP Controller. For example, how much Cache RAM the ICP Controller has and what the current termination setting of the SCSI channel is.


GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
(C) Copyright 1994-1997 ICP vortex Computersysteme GmbH
Controller Information
Controller Type: GDT6537RP
Processor: i960RP-33-3.3, 33MHz (28820013/18861013)
Cache RAM Type: EDO, 60 ns
Cache RAM Size: 16384 KB, 1 bank(s)
Channel Count: 3
Serial Number: 08C0127F
Firmware Version: 02.19.00-R009
Hardware Level: 0
Channel SCSI-ID SCSI Termination
A 7 On
B 7 On
C 7 On
F2:Last Events F3:Fault Bus
GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

Press <F3> to get detailed information on the configuration of the Intelligent Fault Bus (IFB). Changing and enabling these features requires the existence of an IFB-compatible subsystem.


Intelligent Fault Bus
Controller/Channel Settings:
Auto Hot Plug: Enabled SHELF Monitoring: On SHELF Error: Audible Alarm
Channel Fault Bus Swap Detect SHELF State Actual LED code number per ID ID0 ID1 ID2 ID3 ID4 ID5 ID6 ID7
A Disabled 0 NA 0 0 0 0 0 0 0 0
B Disabled -266 Not OK 10 70 19 20 3060 -100 2950 2816
C Enabled -100 Not OK 2816 20 0 40 -996 1109 1133 -306
D Disabled 1130 Not OK 112 30 1109 -266 0 10 70 19
E Disabled -964 Not OK 10 20 1130 -266 0 112 30 1109
LED Code Table:
LED Code No. Description Disk/Array State
0 LED off Disk OK
1 LED on Remove Disk or Insert Disk
2 LED slow blinking Build or Rebuild in progress
3 LED quick blinking Array Idle/Error or Auto Hot Plug aborted
GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

G.3.3 Cache Settings

This submenu displays the current GDT cache settings which can be changed here. The various settings are:

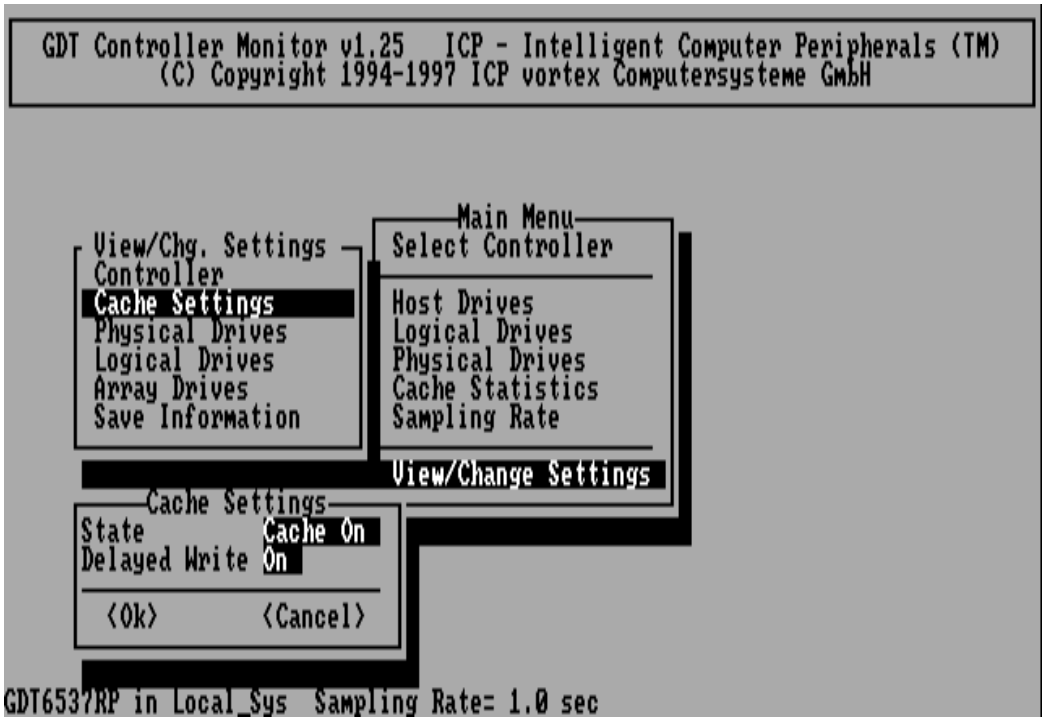
Cache ON — the GDT cache is enabled, that is, all accesses to the Host Drives pass through the GDT cache

Cache OFF — the GDT cache is disabled

Delayed Write ON — Write accesses are delayed, i.e., the write-back cache algorithm is active

Delayed Write OFF — All write accesses are directly transmitted to the Host Drives. If delayed-write is off and the Cache is ON, the GDT cache works exclusively as a read cache.

Note: Best performance is achieved with *Cache* ON and *Delayed Write* ON.

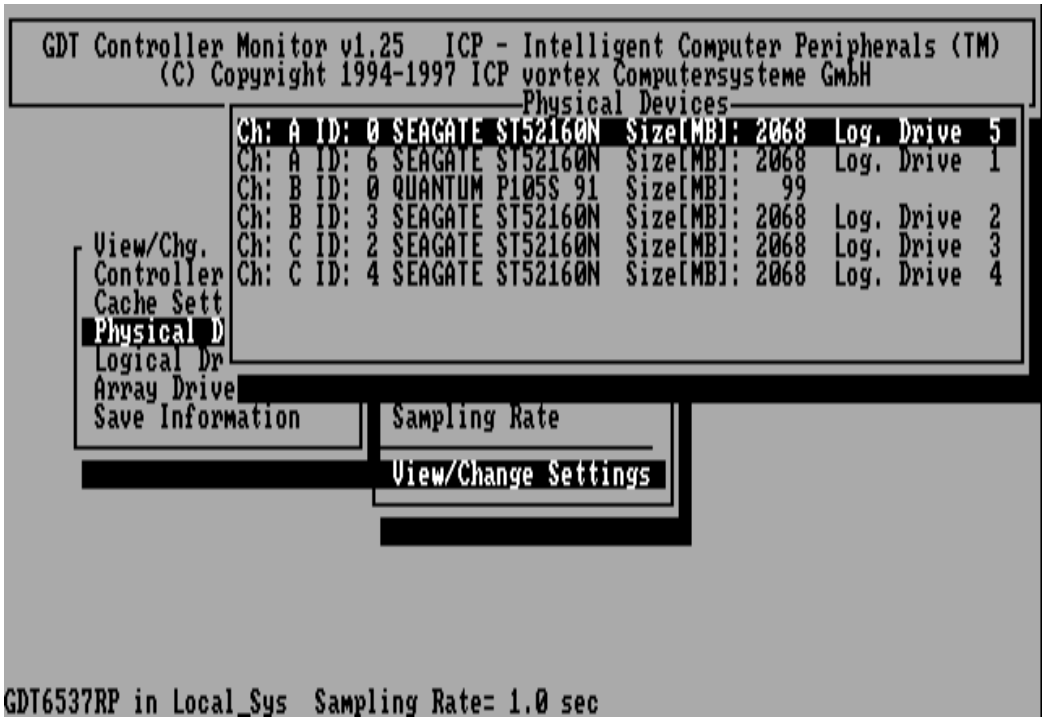


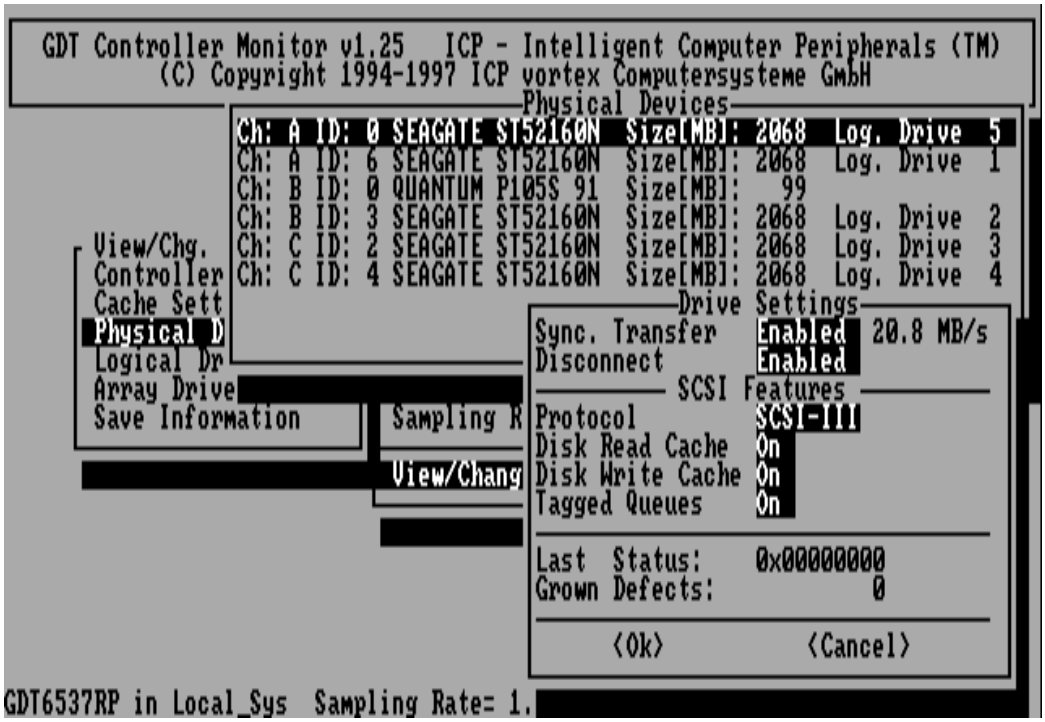
G.3.4 Physical Drives

This option gives a list of all hard disks connected to the ICP Controller. Besides information on the GDT I/O channel, the ID, the name/vendor and the gross capacity (1MB = 1024KB), it also shows which hard disk(s) belong to a given Logical Drive.
When you select a hard disk in this list and then press <ENTER>, GDTMON gives you further information on the D*rive Settings* of this device. These settings may be changed.

The Last Status information should always be 0x00000000. After a device failure or other significant events, a different value may be displayed here.

The Grown Defects counter shows the number of media defects which have occurred since the first time the device was operated with a ICP Controller. A specific hard disk is in a good condition when it has 0 grown defects. When this counter increases, there is definitely something wrong with the device.

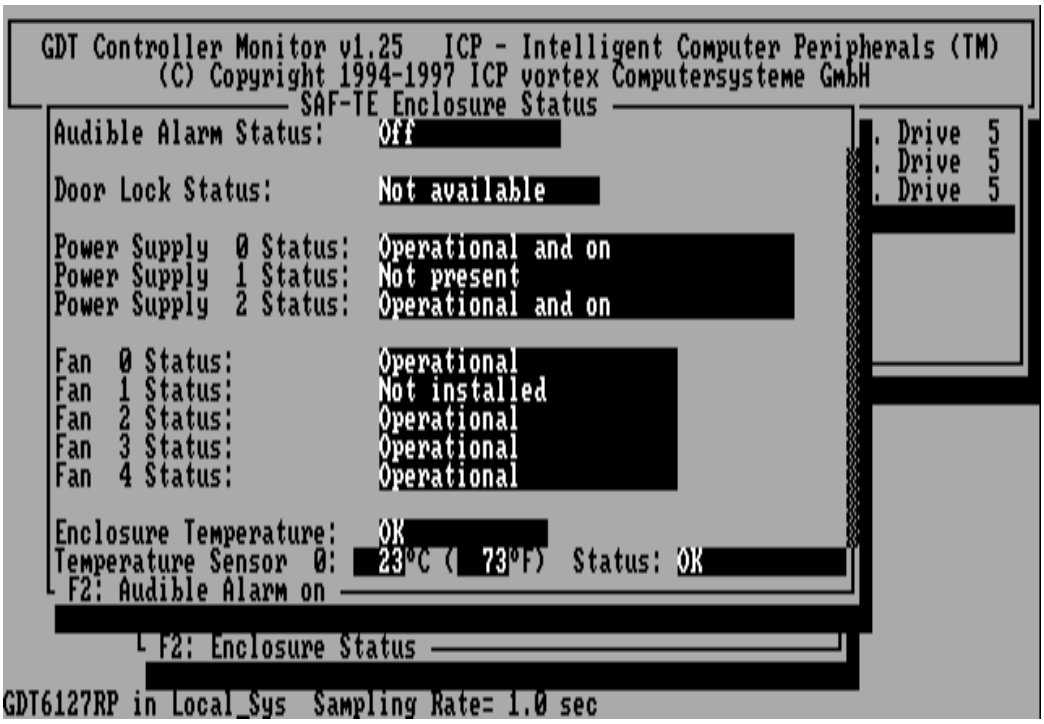

GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
(C) Copyright 1994-1997 ICP vortex Computersysteme GmbH
Physical Devices
Ch: A ID: 0 SEAGATE ST52160N Size[MB]: 2068 Log. Drive 5
Ch: A ID: 6 SEAGATE ST52160N Size[MB]: 2068 Log. Drive 1
Ch: B ID: 0 QUANTUM P105S 91 Size[MB]: 99
Ch: B ID: 3 SEAGATE ST52160N Size[MB]: 2068 Log. Drive 2
Ch: C ID: 2 SEAGATE ST52160N Size[MB]: 2068 Log. Drive 3
Ch: C ID: 4 SEAGATE ST52160N Size[MB]: 2068 Log. Drive 4
View/Chg.
Controller
Cache Sett
Physical D
Logical Dr
Array Drive
Save Information
Sampling Rate
View/Change Settings
GDT6537RP in Local_Sys Sampling Rate= 1.0 sec


GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
(C) Copyright 1994-1997 ICP vortex Computersysteme GmbH
Physical Devices
Ch: A ID: 0 SEAGATE ST52160N Size[MB]: 2068 Log. Drive 5
Ch: A ID: 6 SEAGATE ST52160N Size[MB]: 2068 Log. Drive 1
Ch: B ID: 0 QUANTUM P105S 91 Size[MB]: 99
Ch: B ID: 3 SEAGATE ST52160N Size[MB]: 2068 Log. Drive 2
Ch: C ID: 2 SEAGATE ST52160N Size[MB]: 2068 Log. Drive 3
Ch: C ID: 4 SEAGATE ST52160N Size[MB]: 2068 Log. Drive 4
Drive Settings
Sync. Transfer Enabled 20.8 MB/s
Disconnect Enabled
SCSI Features
Protocol SCSI-III
Disk Read Cache On
Disk Write Cache On
Tagged Queues On
Last Status: 0x00000000
Grown Defects: 0
<Ok> <Cancel>
View/Chg.
Controller
Cache Sett
Physical D
Logical Dr
Array Drive
Save Information
GDT6537RP in Local_Sys Sampling Rate= 1.

If you select the SEP of a SAF-TE subsystem, GDTMON displays a list of the installed and configured slots in the subsystem

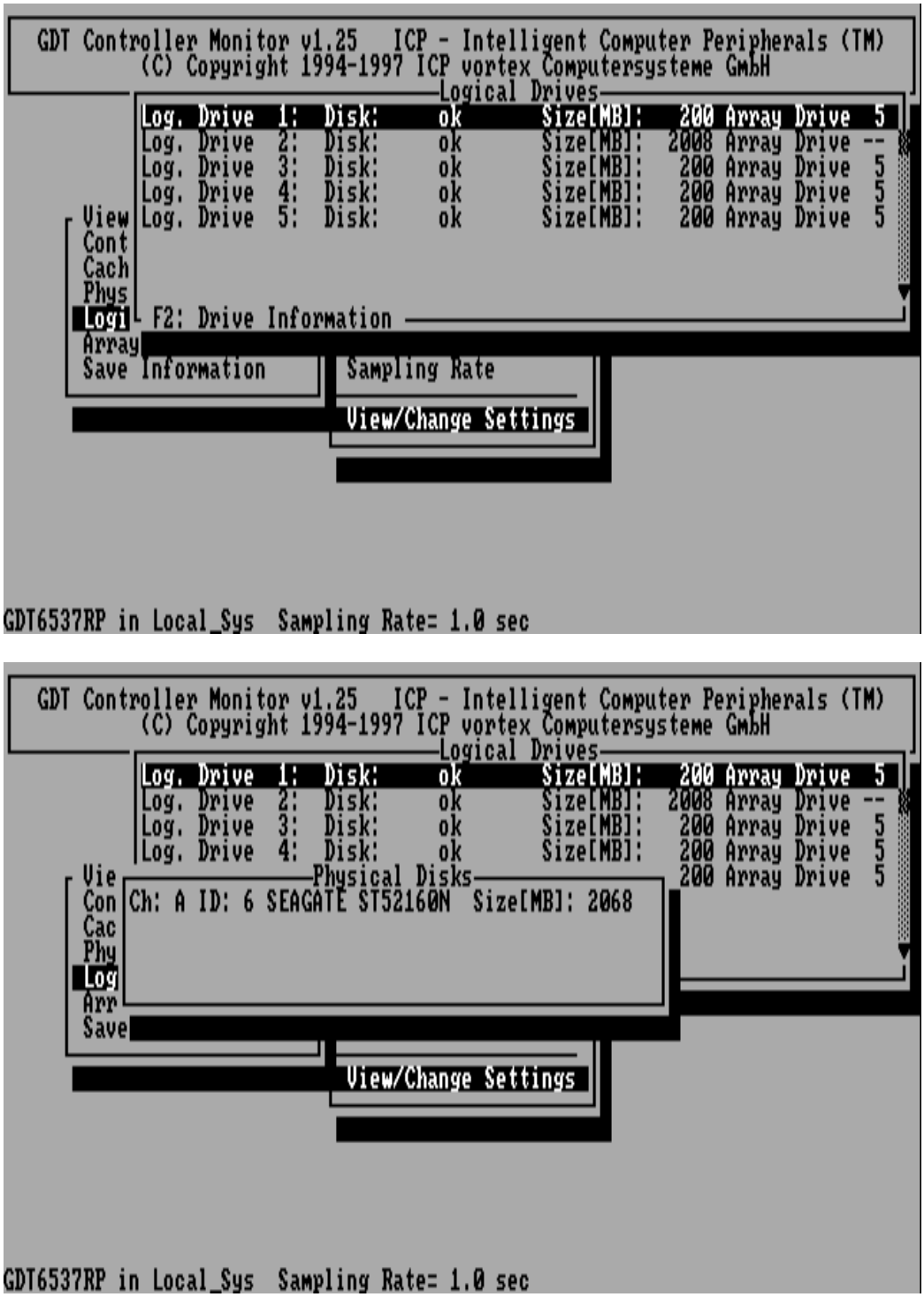
GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
(C) Copyright 1994-1997 ICP vortex Computersysteme GmbH
Physical Devices
Ch: B ID: 0 CONNER CFP2105E Size[MB]: 2047 Log. Drive 5
Ch: B ID: 1 CONNER CFP2105E Size[MB]: 2047 Log. Drive 5
Ch: B ID: 2 CONNER CFP2105E Size[MB]: 2047 Log. Drive 5
Ch: B ID: 3 n$tor CR8 SA
View/Chg.
Con
Cac
Phy
Log
Arr
Sav
SAF-TE Configuration
Slot Installed Disk
0 Ch: B ID: 0 CONNER CFP2105E Size[MB]: 2047
1 Ch: B ID: 1 CONNER CFP2105E Size[MB]: 2047
2 No hard disk installed in this slot
3 No hard disk installed in this slot
4 Slot not present
5 Slot not present
6 Slot not present
7 Slot not present
< Ok > < Cancel >
F2: Enclosure Status
GDT6127RP in Local_Sys Sampling Rate= 1.0 sec

Press <F2> to get the status of the SAF-TE enclosure.


GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
(C) Copyright 1994-1997 ICP vortex Computersysteme GmbH
SAF-TE Enclosure Status
Audible Alarm Status: Off
Door Lock Status: Not available
Power Supply 0 Status: Operational and on
Power Supply 1 Status: Not present
Power Supply 2 Status: Operational and on
Fan 0 Status: Operational
Fan 1 Status: Not installed
Fan 2 Status: Operational
Fan 3 Status: Operational
Fan 4 Status: Operational
Enclosure Temperature: OK
Temperature Sensor 0: 23°C (73°F) Status: OK
F2: Audible Alarm on
F2: Enclosure Status
GDT6127RP in Local_Sys Sampling Rate= 1.0 sec

G.3.5 Logical Drives

This command yields a list of the existing Logical Drives. In addition to the Logical Drive numbers, information on the drives' type, state, net capacity and belonging to a given Array Drive / Host Drive is displayed. Press <F2> to obtain further information on a selected Logical Drive.


GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
(C) Copyright 1994-1997 ICP vortex Computersysteme GmbH
Logical Drives
Log. Drive 1: Disk: ok Size[MB]: 200 Array Drive 5
Log. Drive 2: Disk: ok Size[MB]: 2008 Array Drive --
Log. Drive 3: Disk: ok Size[MB]: 200 Array Drive 5
Log. Drive 4: Disk: ok Size[MB]: 200 Array Drive 5
Log. Drive 5: Disk: ok Size[MB]: 200 Array Drive 5
View
Cont
Cach
Phys
Logi
Array
Save Information
F2: Drive Information
Sampling Rate
View/Change Settings
GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
(C) Copyright 1994-1997 ICP vortex Computersysteme GmbH
Logical Drives
Log. Drive 1: Disk: ok Size[MB]: 200 Array Drive 5
Log. Drive 2: Disk: ok Size[MB]: 2008 Array Drive --
Log. Drive 3: Disk: ok Size[MB]: 200 Array Drive 5
Log. Drive 4: Disk: ok Size[MB]: 200 Array Drive 5
200 Array Drive 5
Physical Disks
Ch: A ID: 6 SEAGATE ST52160N Size[MB]: 2068
Vie
Con
Cac
Phy
Log
Arr
Save
View/Change Settings
GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

Press <ENTER> to select a Logical Drive. The following options become available:

G.3.5.1 Set Logical Drive Name

Change the name of the Logical Drive. This name was defined within GDTSETUP, either automatically, or manually.

G.3.5.2 Hot Plug: Replace Mirror Drive

If a RAID 1 or RAID 10 Host Drive has already been set up, a defective drive can be replaced (Hot Plug) while the system continues to be fully operational.

GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
(C) Copyright 1994-1997 ICP vortex Computersysteme GmbH
Logical Drives
Log. Drive 1: Disk: ok Size[MB]: 200 Array Drive 5
Log. Drive 2: Disk: ok Size[MB]: 2008 Array Drive --
Log. Drive 3: Disk: ok Size[MB]: 200 Array Drive 5
Log. Drive 4: Disk: ok Size[MB]: 200 Array Drive 5
Log. Drive 5: Disk: ok Size[MB]: 200 Array Drive 5
View
Cont
Cach
Phys
Logi
Array
Save Information
Sampling
View/Chan
Logical Drive Settings
Set Log. Drive Name
Hot Plug: Replace Mirror Drive
Hot Plug: Add Mirror Drive
Hot Plug: Remove Mirror Drive
Hot Plug: Add Pool Hot Fix Drive
Hot Plug: Remove Pool Hot Fix Drive
Pool Hot Fix Access
GDT6537RP in Local_Sys Sampling Rate= 1

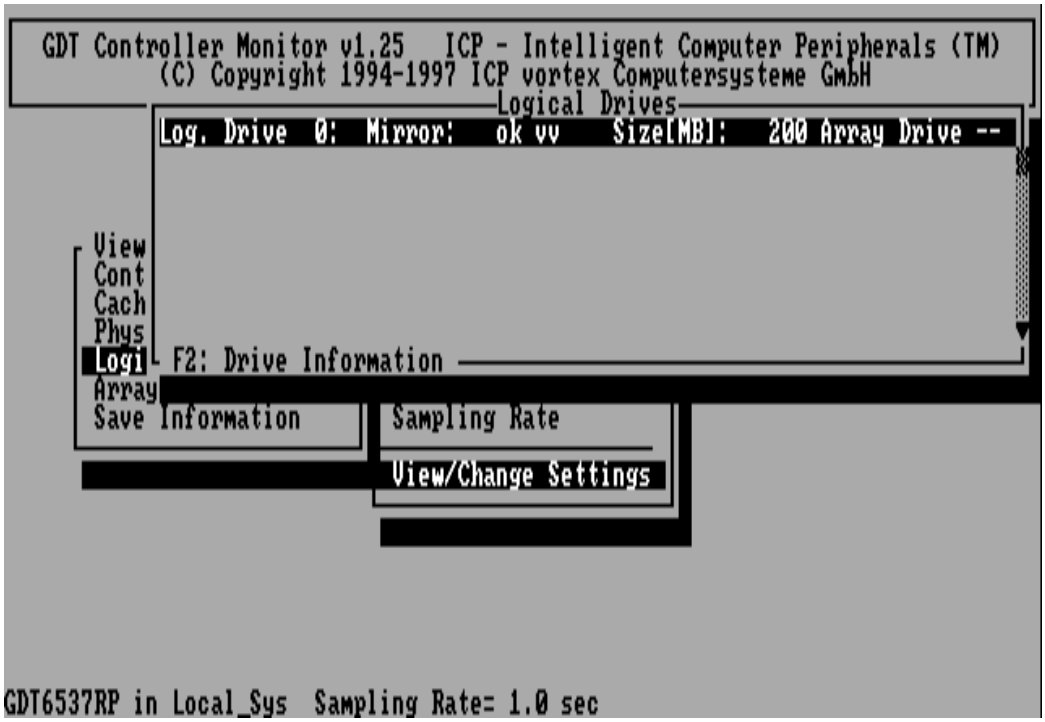
There are typically two different applications, where a Hot Plug becomes necessary.

Application 1. The RAID 1/10 Array Drive is in the fault tolerant (both drives are valid: *vv*). It is likely that a drive will fail soon (for example when there is a loud operating noise). As a preventative measure, this drive ought to be exchanged now, that is, in a moment when the Array Drive is still in a ready state and still has redundancy.

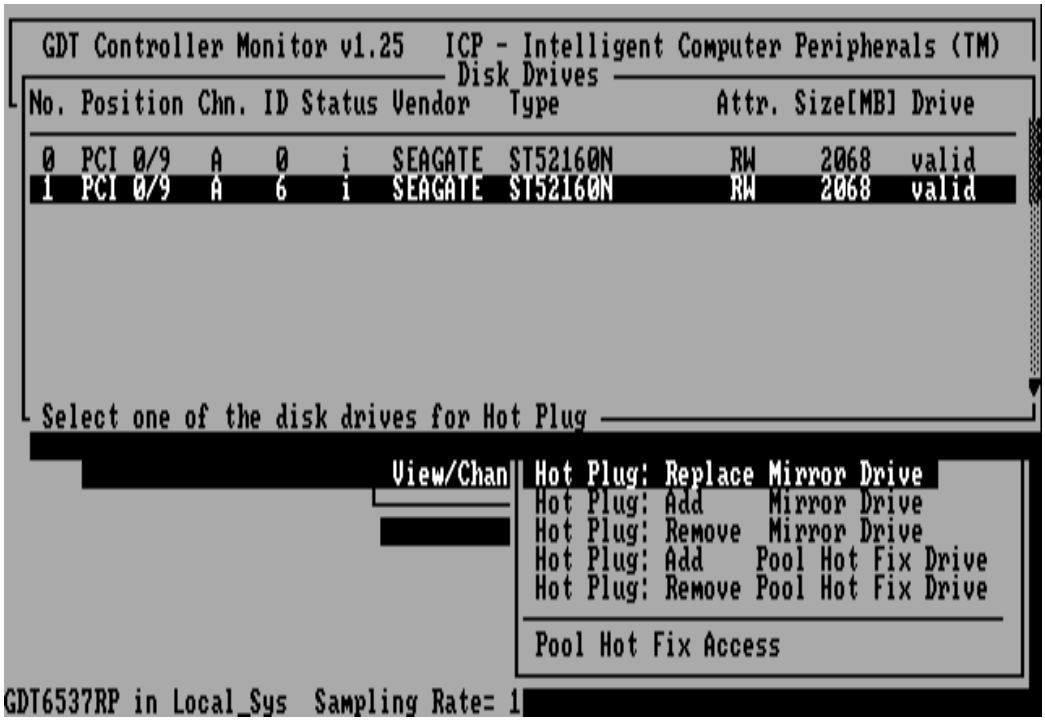
Application 2. The Array Drive is no longer fault tolerant, because a drive of the Array Drive has actually failed. The Array Drive is still fully operational, but it does not have redundancy any more. If another drive should fail, too, the Array Drive's functionality is impaired.

Example Session for Application 1

We assume that there is a RAID 1 Array Drive which is fault tolerant. Its state is *vv*, both Logical Drives are valid. After selecting the Array Drive, we choose the Replace Mirror Drive option.



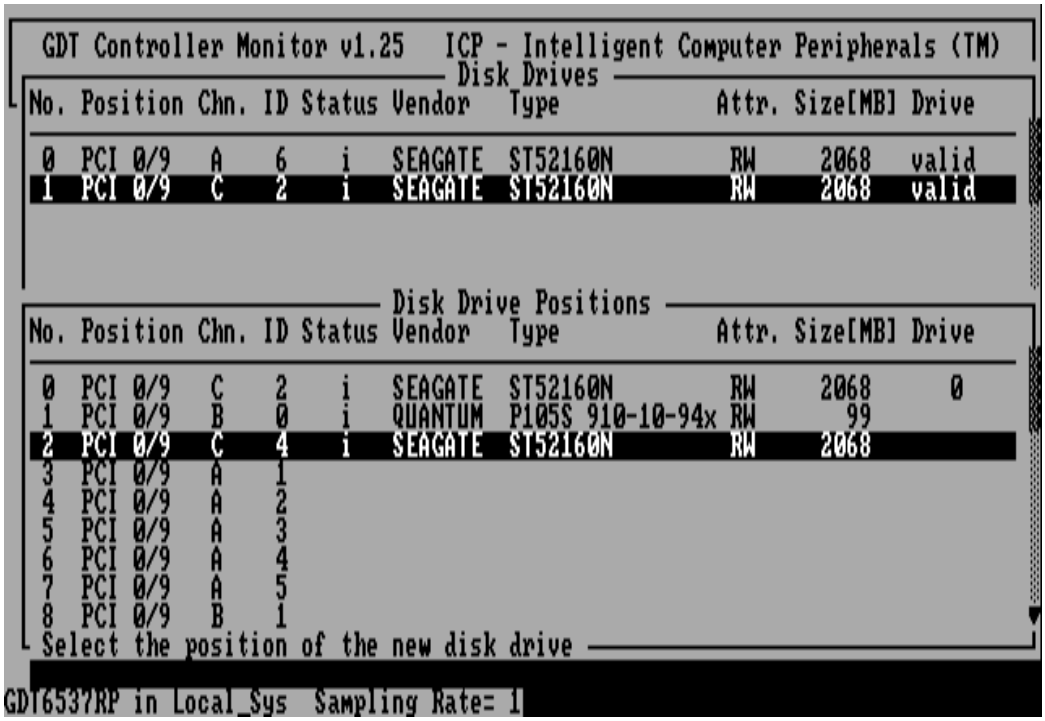
A list is displayed which shows the members of the RAID 1 Array Drive.


GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
Disk Drives
No. Position Chn. ID Status Vendor Type Attr. Size[MB] Drive
0 PCI 0/9 A 0 i SEAGATE ST52160N RW 2068 valid
1 PCI 0/9 A 6 i SEAGATE ST52160N RW 2068 valid
Select one of the disk drives for Hot Plug
View/Chan
Hot Plug: Replace Mirror Drive
Hot Plug: Add Mirror Drive
Hot Plug: Remove Mirror Drive
Hot Plug: Add Pool Hot Fix Drive
Hot Plug: Remove Pool Hot Fix Drive
Pool Hot Fix Access
GDT6537RP in Local_Sys Sampling Rate= 1

GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
Disk Drives
No. Position Chn. ID Status Vendor Type Attr. Size[MB] Drive
0 PCI 0/9 A 6 i SEAGATE ST52160N RW 2068 valid
1 PCI 0/9 C 2 i SEAGATE ST52160N RW 2068 valid
Scanning SCSI channels / target ID's !
Please wait !
or Drive
Hot Plug: Add Mirror Drive
Hot Plug: Remove Mirror Drive
Hot Plug: Add Pool Hot Fix Drive
Hot Plug: Remove Pool Hot Fix Drive
Pool Hot Fix Access
GDT6537RP in Local_Sys Sampling Rate= 1

The Hot Plug function now displays a list of the positions available for the new drive. Each position is univocally determined by its coordinates (I/O channel, ID).Obviously, the new drive can only be assigned to a position which is not occupied by another device yet, exception made for the position still occupied by the drive to be exchanged.

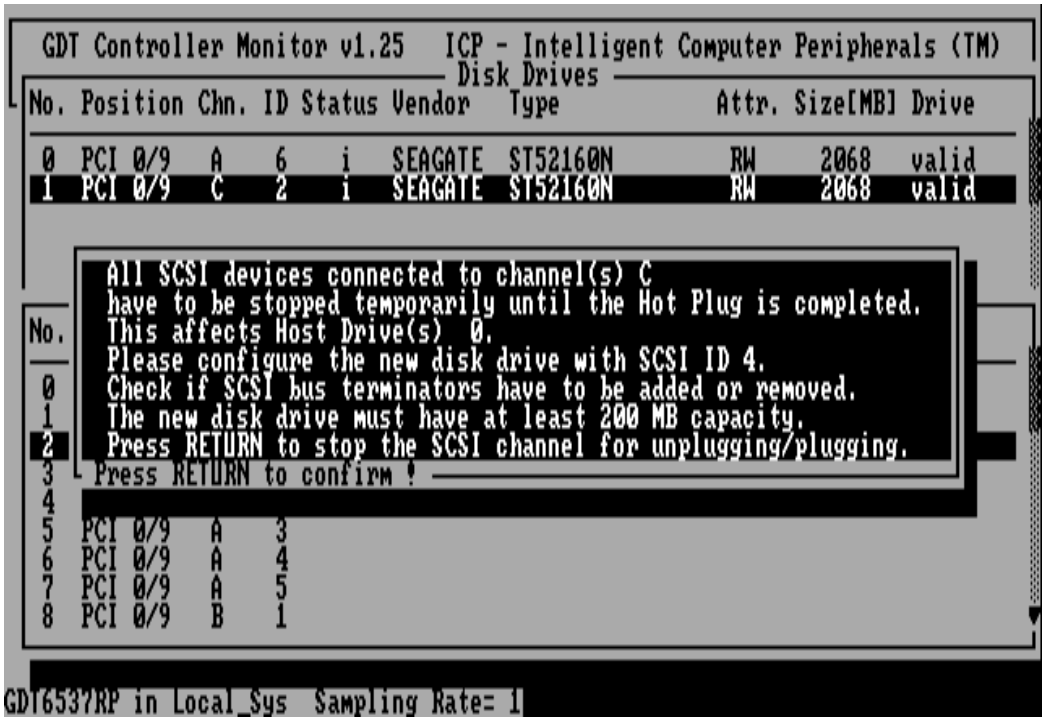
We choose entry number 1 and press <ENTER>.


GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
Disk Drives
No. Position Chn. ID Status Vendor Type Attr. Size[MB] Drive
0 PCI 0/9 A 6 i SEAGATE ST52160N RW 2068 valid
1 PCI 0/9 C 2 i SEAGATE ST52160N RW 2068 valid
Disk Drive Positions
No. Position Chn. ID Status Vendor Type Attr. Size[MB] Drive
0 PCI 0/9 C 2 i SEAGATE ST52160N RW 2068 0
1 PCI 0/9 B 0 i QUANTUM P105S 910-10-94x RW 99
2 PCI 0/9 C 4 i SEAGATE ST52160N RW 2068
3 PCI 0/9 A 1
4 PCI 0/9 A 2
5 PCI 0/9 A 3
6 PCI 0/9 A 4
7 PCI 0/9 A 5
8 PCI 0/9 B 1
Select the position of the new disk drive
GDT6537RP in Local_Sys Sampling Rate= 1

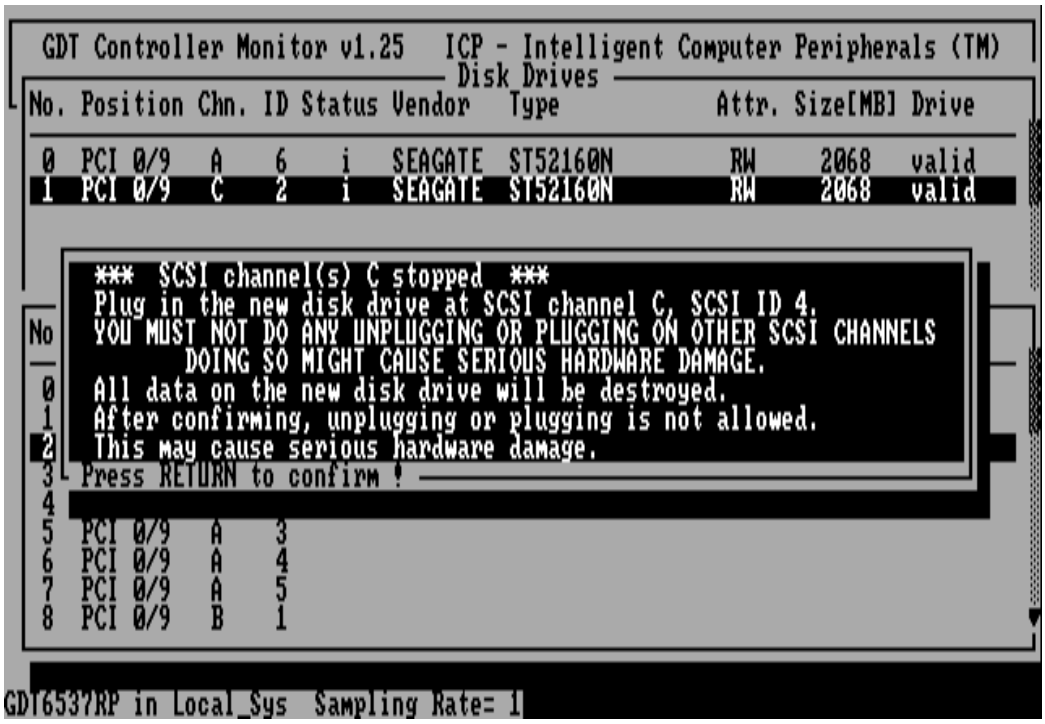
For this example, we select the first position and receive the following message:

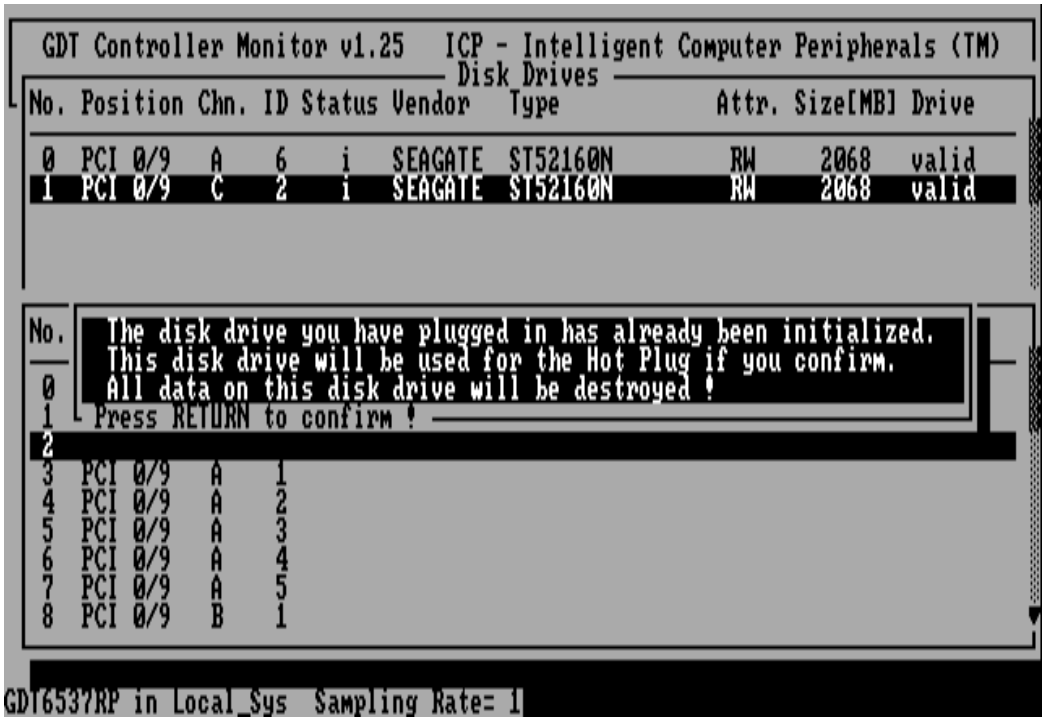
GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
Disk Drives
No. Position Chn. ID Status Vendor Type Attr. Size[MB] Drive
0 PCI 0/9 A 6 i SEAGATE ST52160N RW 2068 valid
1 PCI 0/9 C 2 i SEAGATE ST52160N RW 2068 valid
Do you really want to replace this drive in the mirror union ?
No Yes
Size[MB] Drive
2068 0
99
2068
GDT6537RP in Local_Sys Sampling Rate= 1

The Hot Plug function now informs us that all devices on the I/O channel to which the drive to be exchanged is connected, have to be temporarily halted. In addition, it shows which Host Drives are affected by this brief halt. With regard to the new drive, we are given some important information: Required storage capacity, ID and possible SCSI bus termination. The <ENTER>-key may only be pressed when the new drive is ready at hand and after having checked its capacity, ID and SCSI termination (the latter two may have to be changed). In our example we presume that these preparations have been made, so we press <ENTER> in order to halt the I/O channel.

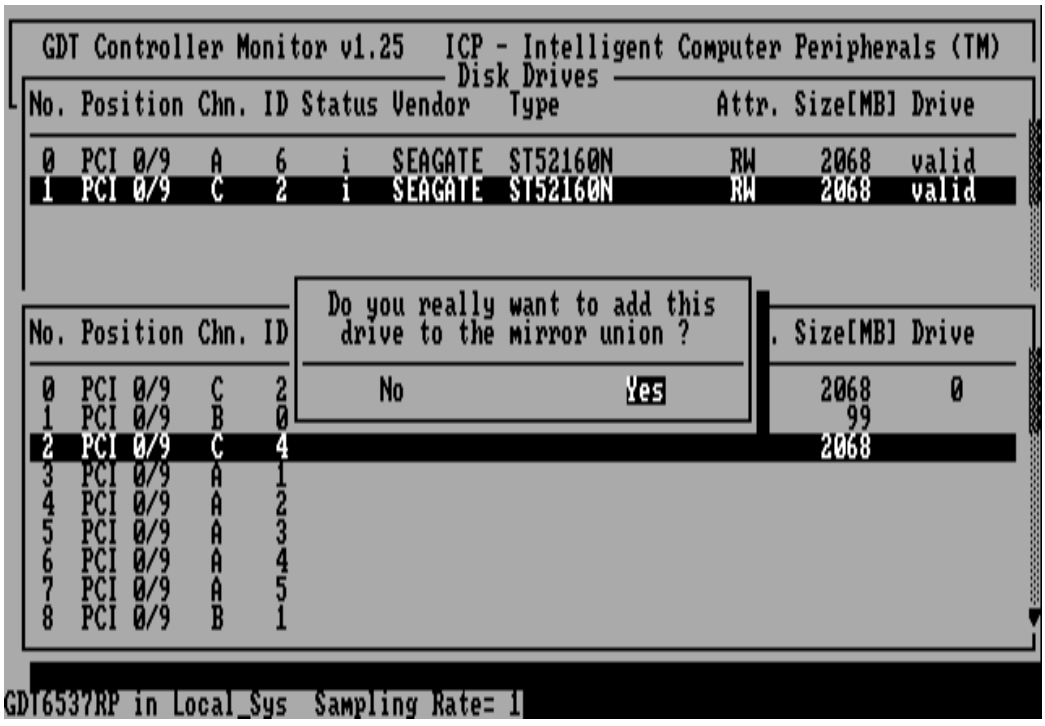

GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
Disk Drives
No. Position Chn. ID Status Vendor Type Attr. Size[MB] Drive
0 PCI 0/9 A 6 i SEAGATE ST52160N RW 2068 valid
1 PCI 0/9 C 2 i SEAGATE ST52160N RW 2068 valid
All SCSI devices connected to channel(s) C
have to be stopped temporarily until the Hot Plug is completed.
This affects Host Drive(s) 0.
Please configure the new disk drive with SCSI ID 4.
Check if SCSI bus terminators have to be added or removed.
The new disk drive must have at least 200 MB capacity.
Press RETURN to stop the SCSI channel for unplugging/plugging.
Press RETURN to confirm !
5 PCI 0/9 A 3
6 PCI 0/9 A 4
7 PCI 0/9 A 5
8 PCI 0/9 B 1
GDT6537RP in Local_Sys Sampling Rate= 1

Now we have entered the actual Hot Plug procedure. Disconnect the drive to be exchanged by plugging it off from the I/O channel first, and then, from the power cable. We immediately connect the new drive to the plugs that are now free, first to the power supply and then to the I/O channel. After having reconnected the new drive properly, press <ENTER>.


GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
Disk Drives
No. Position Chn. ID Status Vendor Type Attr. Size[MB] Drive
0 PCI 0/9 A 6 i SEAGATE ST52160N RW 2068 valid
1 PCI 0/9 C 2 i SEAGATE ST52160N RW 2068 valid
*** SCSI channel(s) C stopped ***
Plug in the new disk drive at SCSI channel C, SCSI ID 4.
YOU MUST NOT DO ANY UNPLUGGING OR PLUGGING ON OTHER SCSI CHANNELS
DOING SO MIGHT CAUSE SERIOUS HARDWARE DAMAGE.
All data on the new disk drive will be destroyed.
After confirming, unplugging or plugging is not allowed.
This may cause serious hardware damage.
Press RETURN to confirm !
5 PCI 0/9 A 3
6 PCI 0/9 A 4
7 PCI 0/9 A 5
8 PCI 0/9 B 1
GDT6537RP in Local_Sys Sampling Rate= 1


GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
Disk Drives
No. Position Chn. ID Status Vendor Type Attr. Size[MB] Drive
0 PCI 0/9 A 6 i SEAGATE ST52160N RW 2068 valid
1 PCI 0/9 C 2 i SEAGATE ST52160N RW 2068 valid
The disk drive you have plugged in has already been initialized.
This disk drive will be used for the Hot Plug if you confirm.
All data on this disk drive will be destroyed !
Press RETURN to confirm !
GDT6537RP in Local_Sys Sampling Rate= 1

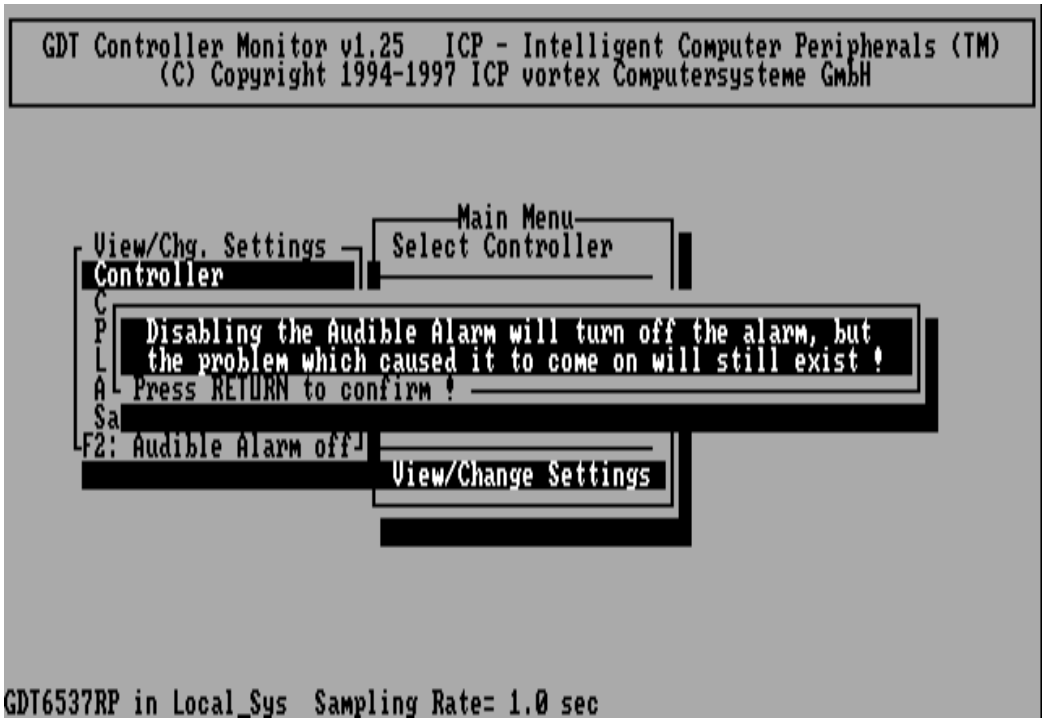
GDTMON recognizes that the new hard disk was already initialized before. Confirmation of this message destroys all data on the selected drive.


GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
Disk Drives
No. Position Chn. ID Status Vendor Type Attr. Size[MB] Drive
0 PCI 0/9 A 6 i SEAGATE ST52160N RW 2068 valid
1 PCI 0/9 C 2 i SEAGATE ST52160N RW 2068 valid
Do you really want to add this drive to the mirror union ?
No Yes
GDT6537RP in Local_Sys Sampling Rate= 1

After this confirmation, the Hot Plug is finished successfully. It takes approximately 10 minutes to re-synchronize the data with this sample configuration.

Example Session for Application 2

We assume that there is a RAID 1 Array Drive which is no longer fault tolerant. Its state is -1/*v*, one drive has failed and is therefore no longer accessible on the I/O channel.
The ICP Controller started beeping. The audible alarm can be disabled within GDTMON by pressing <F2> as soon as the View/Change Settings menu is loaded:


GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
(C) Copyright 1994-1997 ICP vortex Computersysteme GmbH
Main Menu
View/Chg. Settings
Select Controller
Controller
Disabling the Audible Alarm will turn off the alarm, but
the problem which caused it to come on will still exist !
Press RETURN to confirm !
F2: Audible Alarm off
View/Change Settings
GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

After selecting the Array Drive, we choose the Replace Mirror Drive option.

GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
(C) Copyright 1994-1997 ICP vortex Computersysteme GmbH
Logical Drives
Log. Drive 0: Mirror: ok -1/v Size[MB]: 200 Array Drive --
Logical Drive Settings
Set Log. Drive Name
Hot Plug: Replace Mirror Drive
Hot Plug: Add Mirror Drive
Hot Plug: Remove Mirror Drive
Hot Plug: Add Pool Hot Fix Drive
Hot Plug: Remove Pool Hot Fix Drive
Pool Hot Fix Access
Save Information
Sampling
View/Chan
GDT6537RP in Local_Sys Sampling Rate= 1

Before the new drive can be added, the missing drive has to be deleted in the RAID 1 configuration.

GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
(C) Copyright 1994-1997 ICP vortex Computersysteme GmbH
Logical Drives
Log. Drive 0: Mirror: ok -1/v Size[MB]: 200 Array Drive --
View
Cont
Cach
Phys
Logi
Array
Save Inform
Warning: 1 drive(s) missing !
You must remove missing drives first !
Press RETURN to confirm !
ettings
View/Chan
Hot Plug: Replace Mirror Drive
Hot Plug: Add Mirror Drive
Hot Plug: Remove Mirror Drive
Hot Plug: Add Pool Hot Fix Drive
Hot Plug: Remove Pool Hot Fix Drive
Pool Hot Fix Access
GDT6537RP in Local_Sys Sampling Rate= 1

After confirming here with "Yes", you can follow the next paragraph "G.3.5.3 Hot Plug: Add Mirror Drive", to add a new mirror drive to the remaining drive out of the previously failed RAID 1 Array Drive.

G.3.5.3 Hot Plug: Add Mirror Drive

This option allows you to add another Logical Drive as a mirroring drive to another Logical Drive. The new hard disk can be plugged onto the I/O channel while the system continues to be fully operational. If a spare and suitable hard disk is already connected and not yet

assigned to a Logical Drive or Host Drive, it will be displayed in the list of Disk Drive Positions.
There are two cases which make this function very interesting:

1. An existing hard disk should be given 100% redundancy, but there is no time to shut down the system and interrupt the normal operation

2. An existing hard disk has a high probability of failure, because it makes, for example, a strange noise or generates a lot of grown defects, but there is no time to shut down the system and interrupt the normal operation.

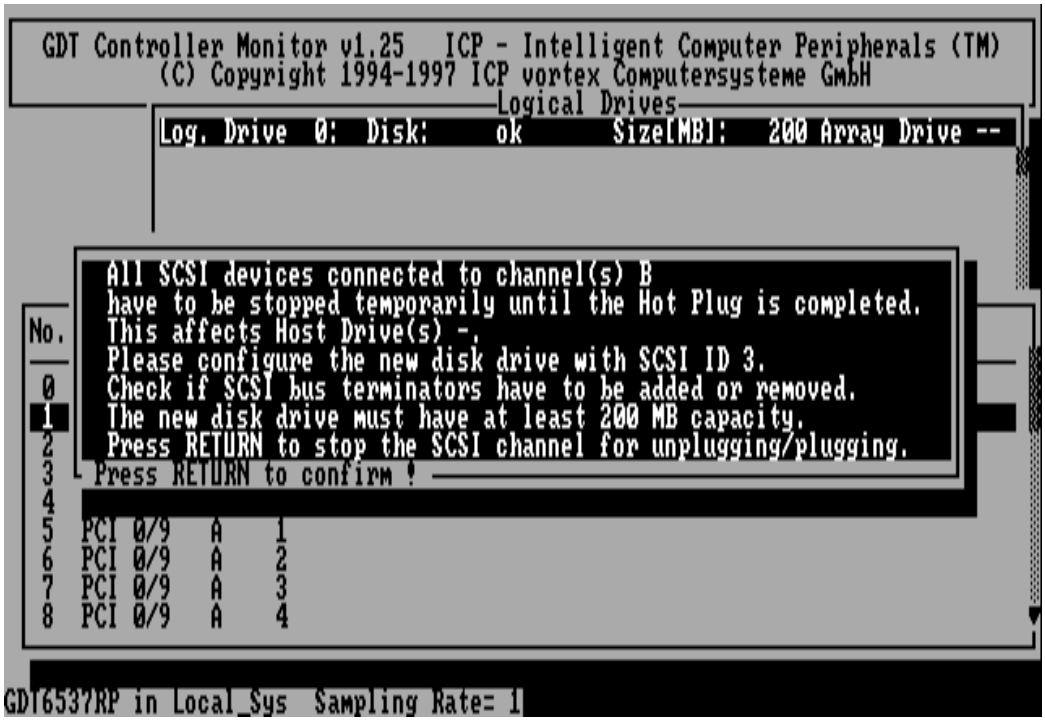
Once the new hard disk is added, the data synchronization (mirroring update) is automatically carried out in the background simultaneously with the normal operation.

GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
(C) Copyright 1994-1997 ICP vortex Computersysteme GmbH
Logical Drives
Log. Drive 0: Disk: ok Size[MB]: 200 Array Drive --
View
Cont
Cach
Phys
Logi
Array
Save Infor
Scanning SCSI channels / target ID's !
Please wait !
ettings
or Drive
Hot Plug: Add Mirror Drive
Hot Plug: Remove Mirror Drive
Hot Plug: Add Pool Hot Fix Drive
Hot Plug: Remove Pool Hot Fix Drive
Pool Hot Fix Access
GDT6537RP in Local_Sys Sampling Rate= 1

In this example, there was already a spare hard disk available (on Channel B, SCSI ID 3). This drive must not be a Logical Drive. Otherwise it will not be available for this function.

GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
(C) Copyright 1994-1997 ICP vortex Computersysteme GmbH
Logical Drives
Log. Drive 0: Disk: ok Size[MB]: 200 Array Drive --
View
Cont
Disk Drive Positions
No. Position Chn. ID Status Vendor Type Attr. Size[MB] Drive
0 PCI 0/9 B 0 i QUANTUM P105S 910-10-94x RW 99
1 PCI 0/9 B 3 i SEAGATE ST52160N RW 2068
2 PCI 0/9 C 2 i SEAGATE ST52160N RW 2068
3 PCI 0/9 C 4 i SEAGATE ST52160N RW 2068
4 PCI 0/9 A 0
5 PCI 0/9 A 1
6 PCI 0/9 A 2
7 PCI 0/9 A 3
8 PCI 0/9 A 4
Select the position of the new disk drive
GDT6537RP in Local_Sys Sampling Rate= 1

After selecting the new hard disk, the following message appears:


GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
(C) Copyright 1994-1997 ICP vortex Computersysteme GmbH
Logical Drives
Log. Drive 0: Disk: ok Size[MB]: 200 Array Drive --
All SCSI devices connected to channel(s) B
have to be stopped temporarily until the Hot Plug is completed.
This affects Host Drive(s) -.
Please configure the new disk drive with SCSI ID 3.
Check if SCSI bus terminators have to be added or removed.
The new disk drive must have at least 200 MB capacity.
Press RETURN to stop the SCSI channel for unplugging/plugging.
Press RETURN to confirm !
No.
0
1
2
3
4
5 PCI 0/9 A 1
6 PCI 0/9 A 2
7 PCI 0/9 A 3
8 PCI 0/9 A 4
GDT6537RP in Local_Sys Sampling Rate= 1

The following message indicates that channel B was stopped for the time of the actual Hot Plug

GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
(C) Copyright 1994-1997 ICP vortex Computersysteme GmbH
Logical Drives
Log. Drive 0: Disk: ok Size[MB]: 200 Array Drive --
*** SCSI channel(s) B stopped ***
Plug in the new disk drive at SCSI channel B, SCSI ID 3.
YOU MUST NOT DO ANY UNPLUGGING OR PLUGGING ON OTHER SCSI CHANNELS
DOING SO MIGHT CAUSE SERIOUS HARDWARE DAMAGE.
All data on the new disk drive will be destroyed.
After confirming, unplugging or plugging is not allowed.
This may cause serious hardware damage.
Press RETURN to confirm !
No
0
1
2
3
4
5 PCI 0/9 A 1
6 PCI 0/9 A 2
7 PCI 0/9 A 3
8 PCI 0/9 A 4
GDT6537RP in Local_Sys Sampling Rate= 1

Now, the new hard disk is added as a mirror to the selected Logical Drive. The updated list of available Logical Drives shows the change. The Logical Drive changed its type to M*irror* and the data on the new hard disk are currently synchronized, indicated through the "*" behind the "v".

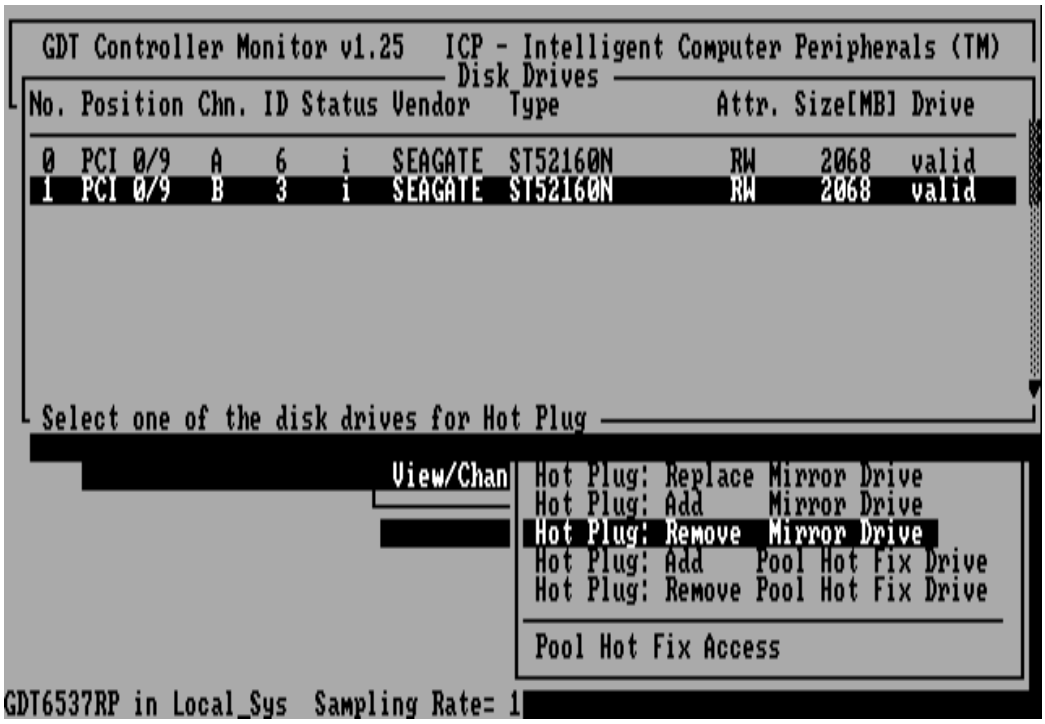
After pressing <F2>, the new structure is displayed.

GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
(C) Copyright 1994-1997 ICP vortex Computersysteme GmbH
Logical Drives
Log. Drive 0: Mirror: ok v* Size[MB]: 200 Array Drive --
Mirror Drive Components
Log. Drive: Name: DISK_A6 Disk: valid Size[MB]: 200
Log. Drive: Name: DISK_B3 Disk: invalid Size[MB]: 200
View
Cont
Cach
Phys
Logi
Array
Save Info
F2:
F2: Drive Information
GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

The entry "invalid" for the second drive means that the data have not yet been (completely) copied from the first drive. After the completion of the synchronization process, this entry changes into "valid".

G.3.5.4 Hot Plug: Remove Mirror Drive

This option allows the removal of a Mirror Drive from a RAID 1 or RAID 10 Array Drive. Once the drive has been removed, the data on the other drive are no longer redundant.


GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
Disk Drives
No. Position Chn. ID Status Vendor Type Attr. Size[MB] Drive
0 PCI 0/9 A 6 i SEAGATE ST52160N RW 2068 valid
1 PCI 0/9 B 3 i SEAGATE ST52160N RW 2068 valid
Select one of the disk drives for Hot Plug
View/Chan
Hot Plug: Replace Mirror Drive
Hot Plug: Add Mirror Drive
Hot Plug: Remove Mirror Drive
Hot Plug: Add Pool Hot Fix Drive
Hot Plug: Remove Pool Hot Fix Drive
Pool Hot Fix Access
GDT6537RP in Local_Sys Sampling Rate= 1

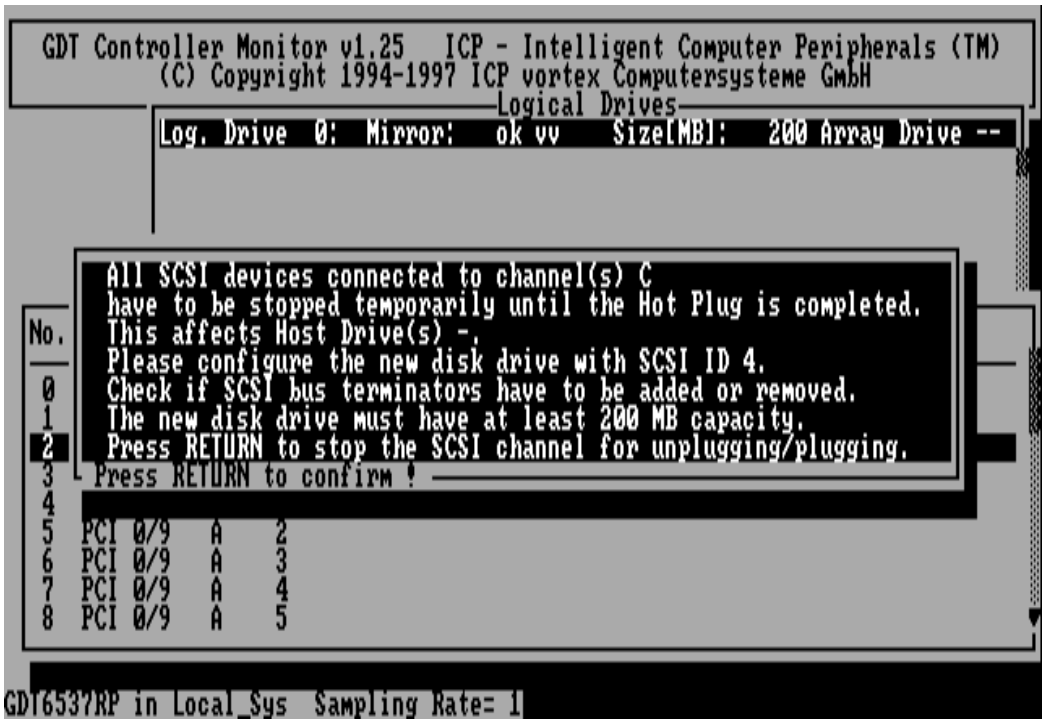
G.3.5.5 Hot Plug: Add Pool Hot Fix Drive

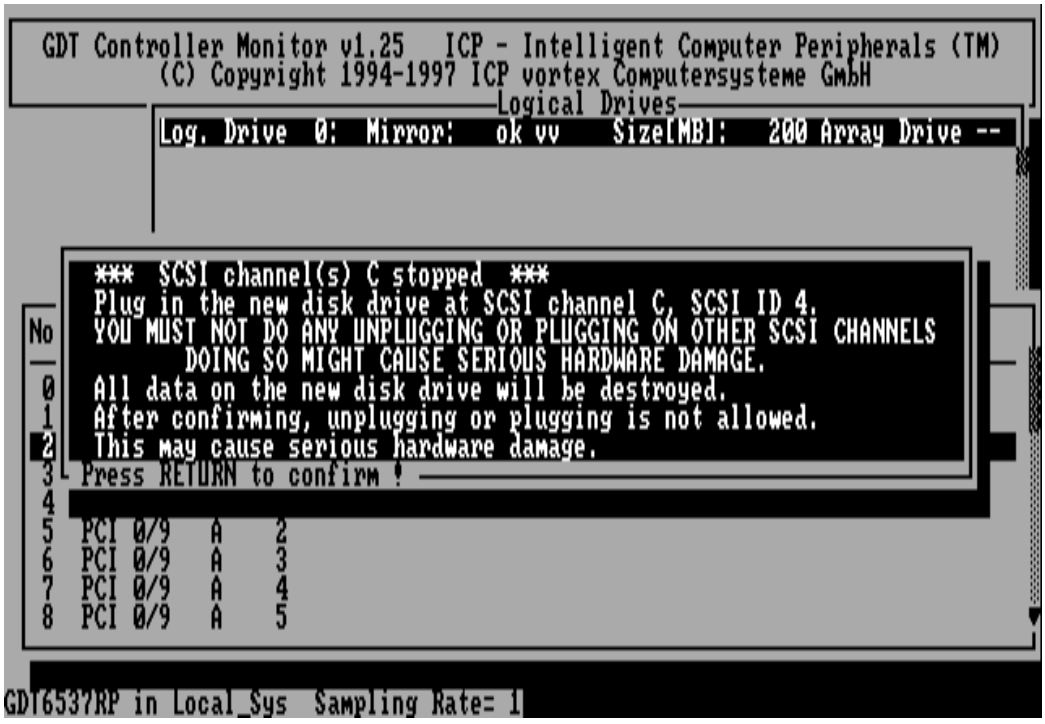
A Pool Hot Fix Drive is a spare drive within the so-called Hot Fix Pool. A drive in a Hot Fix Pool is available for several RAID 1 and RAID 10 Array Drives as a Hot Fix drive. Thus, several Array Drives can share one Hot Fix drive. Of course, once this drive has been used by one of the Array Drives, it is no longer available for the others.

After selecting this option, GDTMON scans the ICP Controller for drives which are suitable

GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
(C) Copyright 1994-1997 ICP vortex Computersysteme GmbH
Logical Drives
Log. Drive 0: Mirror: ok vv Size[MB]: 200 Array Drive --
View
Cont
Disk Drive Positions
No. Position Chn. ID Status Vendor Type Attr. Size[MB] Drive
0 PCI 0/9 B 0 i QUANTUM P105S 910-10-94x RW 99
1 PCI 0/9 C 2 i SEAGATE ST52160N RW 2068
2 PCI 0/9 C 4 i SEAGATE ST52160N RW 2068
3 PCI 0/9 A 0
4 PCI 0/9 A 1
5 PCI 0/9 A 2
6 PCI 0/9 A 3
7 PCI 0/9 A 4
8 PCI 0/9 A 5
Select the position of the new disk drive
GDT6537RP in Local_Sys Sampling Rate= 1

for becoming a Pool Hot Fix drive (i.e. they belong to no Logical Drive), and for free coordinates (SCSI Channel / SCSI ID). We choose Channel C and SCSI ID 4 for the new Hot Fix Drive.

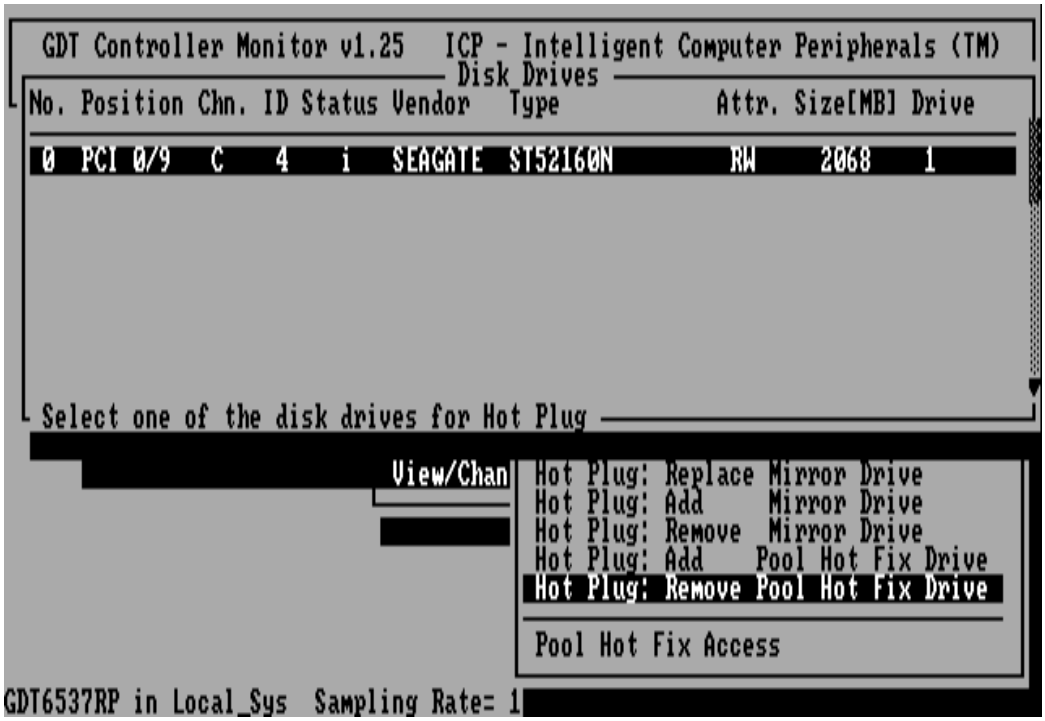

GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
(C) Copyright 1994-1997 ICP vortex Computersysteme GmbH
Logical Drives
Log. Drive 0: Mirror: ok vv Size[MB]: 200 Array Drive --
All SCSI devices connected to channel(s) C
have to be stopped temporarily until the Hot Plug is completed.
This affects Host Drive(s) -.
Please configure the new disk drive with SCSI ID 4.
Check if SCSI bus terminators have to be added or removed.
The new disk drive must have at least 200 MB capacity.
Press RETURN to stop the SCSI channel for unplugging/plugging.
Press RETURN to confirm !
No.
0
1
2
3
4
5 PCI 0/9 A 2
6 PCI 0/9 A 3
7 PCI 0/9 A 4
8 PCI 0/9 A 5
GDT6537RP in Local_Sys Sampling Rate= 1


GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
(C) Copyright 1994-1997 ICP vortex Computersysteme GmbH
Logical Drives
Log. Drive 0: Mirror: ok vv Size[MB]: 200 Array Drive --
*** SCSI channel(s) C stopped ***
Plug in the new disk drive at SCSI channel C, SCSI ID 4.
YOU MUST NOT DO ANY UNPLUGGING OR PLUGGING ON OTHER SCSI CHANNELS
DOING SO MIGHT CAUSE SERIOUS HARDWARE DAMAGE.
All data on the new disk drive will be destroyed.
After confirming, unplugging or plugging is not allowed.
This may cause serious hardware damage.
Press RETURN to confirm !
No
0
1
2
3
4
5 PCI 0/9 A 2
6 PCI 0/9 A 3
7 PCI 0/9 A 4
8 PCI 0/9 A 5
GDT6537RP in Local_Sys Sampling Rate= 1

After the completion of this function, the Pool of Hot Fix drives contains a new drive (in our example here, it is the only drive.
To allow a RAID 1 or RAID 10 Array Drive access to the Hot Fix Pool, use the Pool Hot Fix Access menu (G.3.5.7).

G.3.5.6 Hot Plug: Remove Pool Hot Fix Drive

It may become necessary to remove a certain drive from the Hot Fix Pool.


GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
Disk Drives
No. Position Chn. ID Status Vendor Type Attr. Size[MB] Drive
0 PCI 0/9 C 4 i SEAGATE ST52160N RW 2068 1
Select one of the disk drives for Hot Plug
View/Chan
Hot Plug: Replace Mirror Drive
Hot Plug: Add Mirror Drive
Hot Plug: Remove Mirror Drive
Hot Plug: Add Pool Hot Fix Drive
Hot Plug: Remove Pool Hot Fix Drive
Pool Hot Fix Access
GDT6537RP in Local_Sys Sampling Rate= 1

G.3.5.7 Pool Hot Fix Access

This function enables or disables the access of a certain RAID 1 or RAID 10 Array Drive to the Hot Fix Pool.

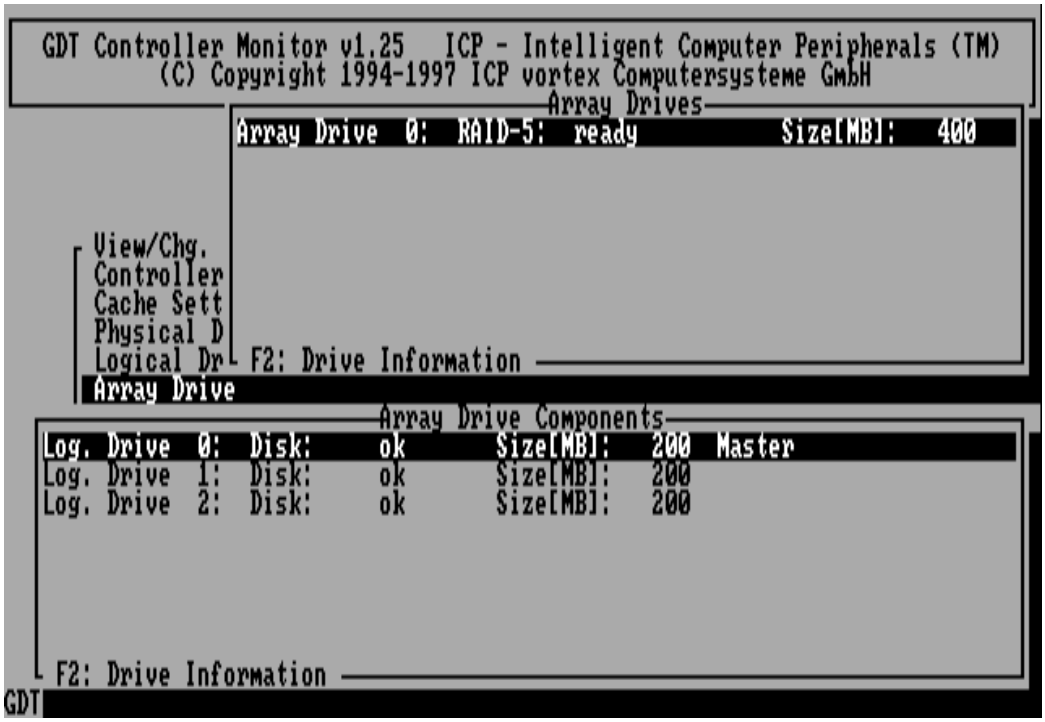
GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
(C) Copyright 1994-1997 ICP vortex Computersysteme GmbH
Logical Drives
Log. Drive 0: Mirror: ok vv Size[MB]: 200 Array Drive --
Log. Drive 1: Disk: ok Size[MB]: 2068 Hot Fix Pool
The access to the Hot Fix Pool is enabled !
Do you want to disable it ?
No
Yes
View/Chan
Hot Plug: Replace Mirror Drive
Hot Plug: Add Mirror Drive
Hot Plug: Remove Mirror Drive
Hot Plug: Add Pool Hot Fix Drive
Hot Plug: Remove Pool Hot Fix Drive
Pool Hot Fix Access
GDT6537RP in Local_Sys Sampling Rate= 1

If the access had been enabled before, you could disable it now.

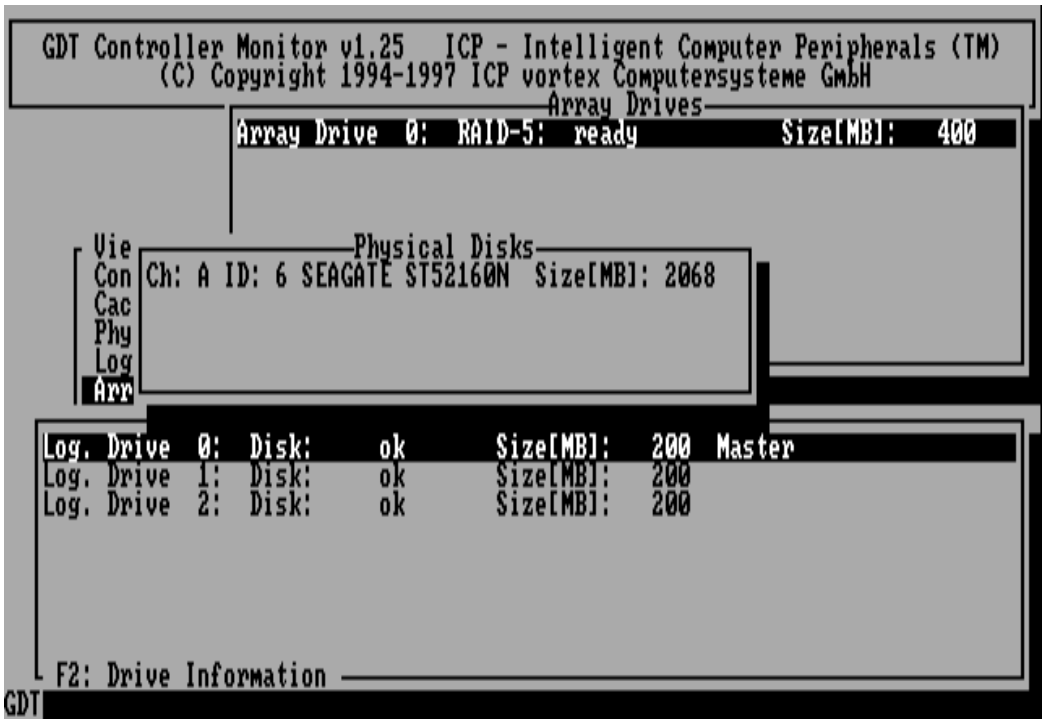
G.3.6 Array Drives

This command yields a list of the existing RAID 4 and RAID 5 Array Drives. In addition to the Array Drive number, information on the RAID level of the Array Drive: 4 or 5), the state

(error, idle, build, ready, fail, expand, rebuild) and the net capacity are displayed. Press <F2> to obtain further information on a selected Array Drive.


GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
(C) Copyright 1994-1997 ICP vortex Computersysteme GmbH
Array Drives
Array Drive 0: RAID-5: ready Size[MB]: 400
View/Chg.
Controller
Cache Sett
Physical D
Logical Dr
F2: Drive Information
Array Drive
Array Drive Components
Log. Drive 0: Disk: ok Size[MB]: 200 Master
Log. Drive 1: Disk: ok Size[MB]: 200
Log. Drive 2: Disk: ok Size[MB]: 200
F2: Drive Information
GDT

If you press once more <F2>, you get detailed information on the physical hard disk.


GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
(C) Copyright 1994-1997 ICP vortex Computersysteme GmbH
Array Drives
Array Drive 0: RAID-5: ready Size[MB]: 400
Physical Disks
Ch: A ID: 6 SEAGATE ST52160N Size[MB]: 2068
Log. Drive 0: Disk: ok Size[MB]: 200 Master
Log. Drive 1: Disk: ok Size[MB]: 200
Log. Drive 2: Disk: ok Size[MB]: 200
F2: Drive Information
GDT

G.3.6.1 Parity Verify

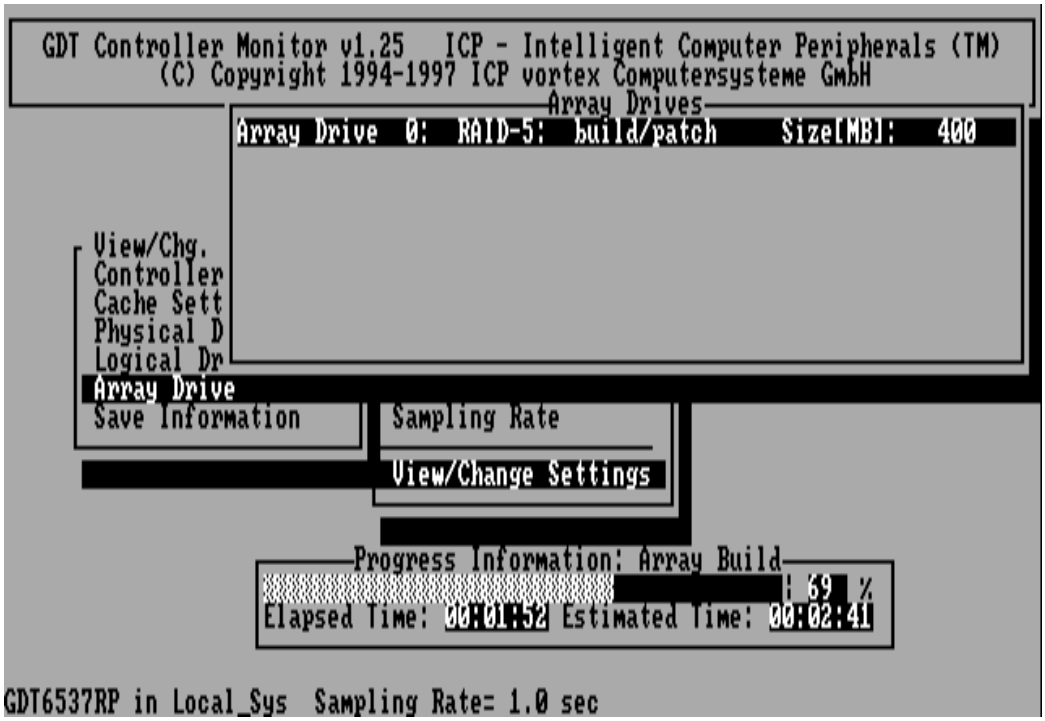
This option verifies online the parity information of the selected RAID 4 or RAID 5 Array Drive. Pressing <ESC> terminates this process. If this option is selected for several Array Drives, the processes are put into a queue and performed one after the other.

G.3.6.2 Parity Recalculate

If the parity verify option reports a parity problem, it is advisable to recalculate the parity of the selected Array Drive anew.

GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
(C) Copyright 1994-1997 ICP vortex Computersysteme GmbH
Array Drives
Array Drive 0: RAID-5: ready Size[MB]: 400
View/Chg.
Controller
Cache Sett
Physical D
Logical Dr
Array Drive
Save Informat
Do you really want to recalculate
the parity of the array union ?
No
Yes
View/Chan
Hot Plug: Replace Drive
Hot Plug: Add priv. Hot Fix Drive
Hot Plug: Add Pool Hot Fix Drive
Hot Plug: Remove priv. Hot Fix Drive
Hot Plug: Remove Pool Hot Fix Drive
GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

The state of the Array Drive changes into "build/patch", and the build process is started immediately. The word "patch" indicates that the parity of this Array Drive was calculated anew. After this procedure the Array Drive assumes the *ready/patch* sate.



G.3.6.3 Expand Array Drive

There are two fundamental functions which are available within this option:

- Migrate the RAID level of the selected RAID Array Drive
  (RAID 0-> RAID 4 and vice versa, RAID 0 -> RAID 5 and vice versa)

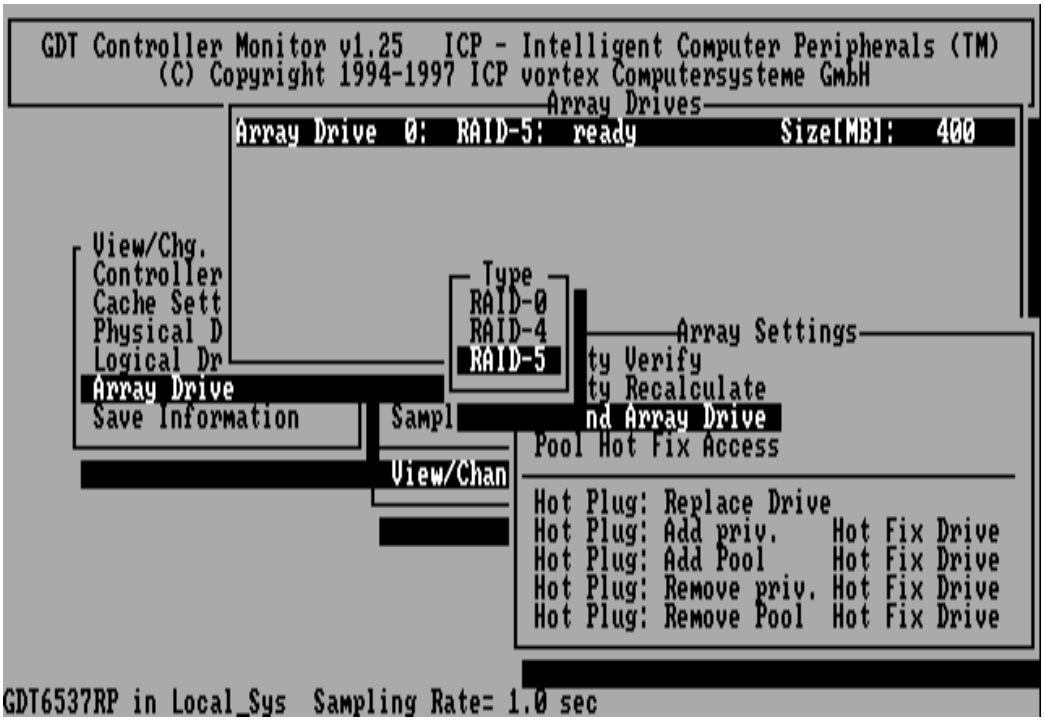
- Expand the capacity of the selected Array Drive by adding one or several new hard disks

Both functions can be selected at the same time. E.g., migrate from RAID 0 to RAID 5 and add a new drive.

To initiate a migration or expansion with a RAID 4/5 Array Drive, the state must be *ready*.
The data on the Array Drive remain intact and are not affected by the expansion.
The additional capacity is introduced as new Host Drive.
If a Logical Drive fails during the expansion, the expansion process continues until the expansion is finished. The Array Drive changes into the *fail* state.

The new capacity is available as a new Host Drive. Windows NT (Tool: Disk Administrator) and Novell NetWare (*Scan for new Devices* and then Tool: Install) allow the online integration of new disk capacity.

Depending on the RAID level the current Array Drive has, selecting a different one here, will cause the Migration of the RAID level of the Array Drive. If you select the same RAID level, the following procedure will expand the capacity of the Array Drive, only.



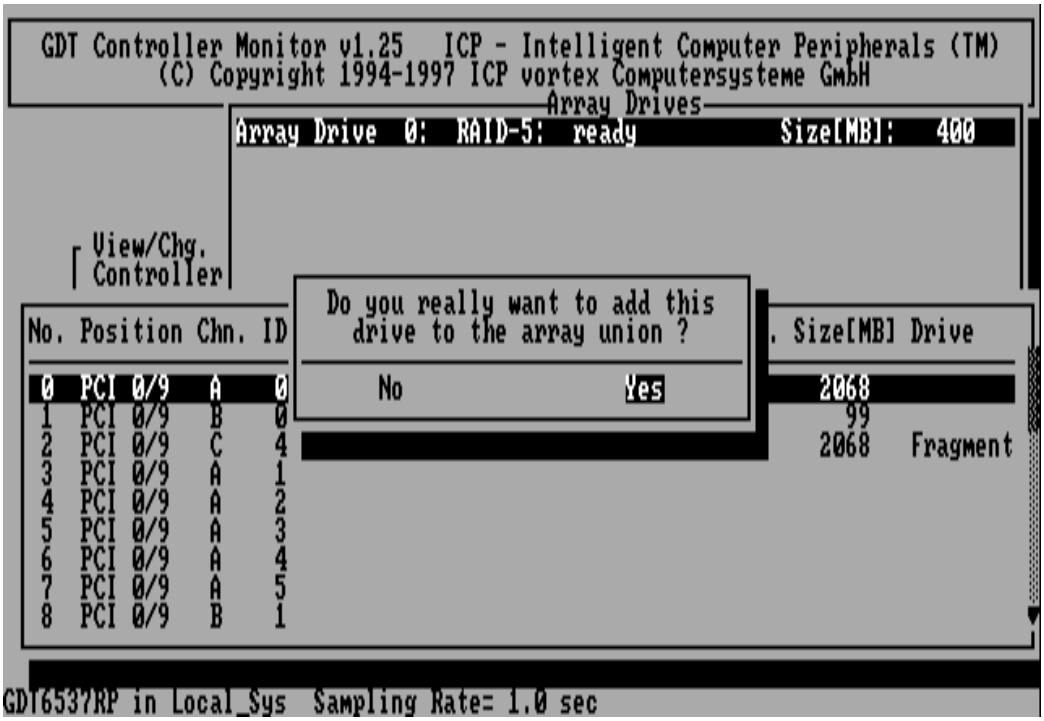
GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
(C) Copyright 1994-1997 ICP vortex Computersysteme GmbH
Array Drives
Array Drive 0: RAID-5: ready Size[MB]: 400
View/Chg.
Controller
Cache Sett
Physical D
Logical Dr
Array Drive
Save Informatio
Do you want to add a new drive
to the array ?
No
Yes
Hot Plug: Replace Drive
Hot Plug: Add priv. Hot Fix Drive
Hot Plug: Add Pool Hot Fix Drive
Hot Plug: Remove priv. Hot Fix Drive
Hot Plug: Remove Pool Hot Fix Drive
GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

After confirming this request, the I/O channels are scanned for free positions and already existing available (i.e., not yet assigned to a Logical Drive) hard disks.

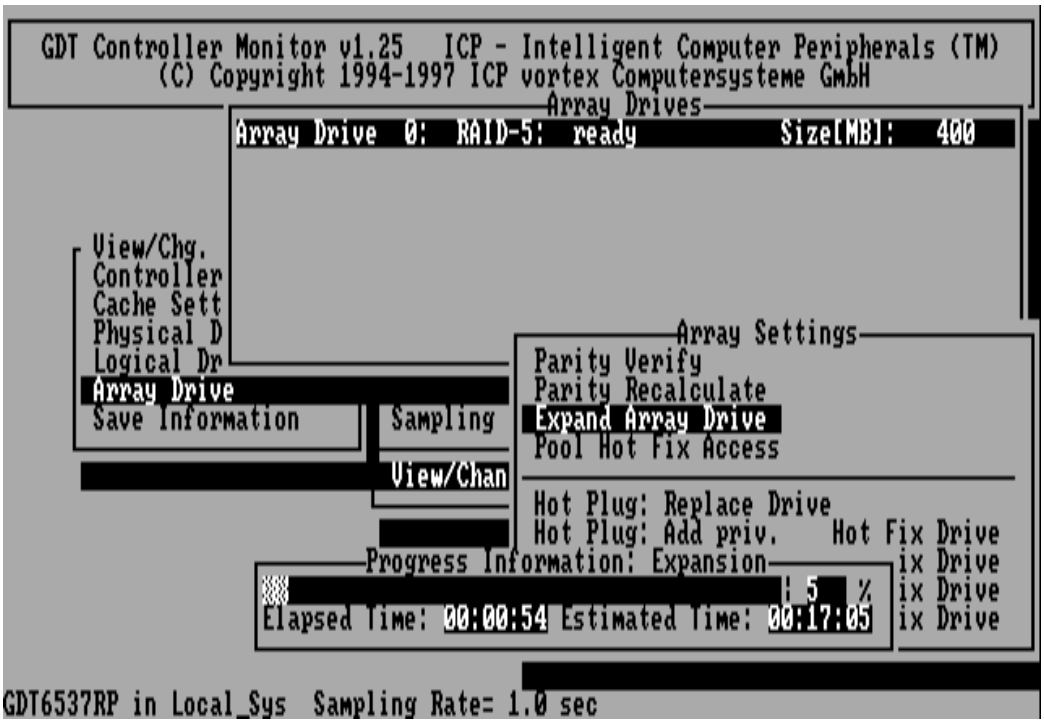
GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
(C) Copyright 1994-1997 ICP vortex Computersysteme GmbH
Array Drives
Array Drive 0: RAID-5: ready Size[MB]: 400
View/Chg.
Controller
Cache Sett
Physical D
Logical Dr
Array Driv
Save Infor
Scanning SCSI channels / target ID's !
Please wait !
Hot Plug: Replace Drive
Hot Plug: Add priv. Hot Fix Drive
Hot Plug: Add Pool Hot Fix Drive
Hot Plug: Remove priv. Hot Fix Drive
Hot Plug: Remove Pool Hot Fix Drive
GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

For this demo, we select the hard disk on channel A and ID 0.

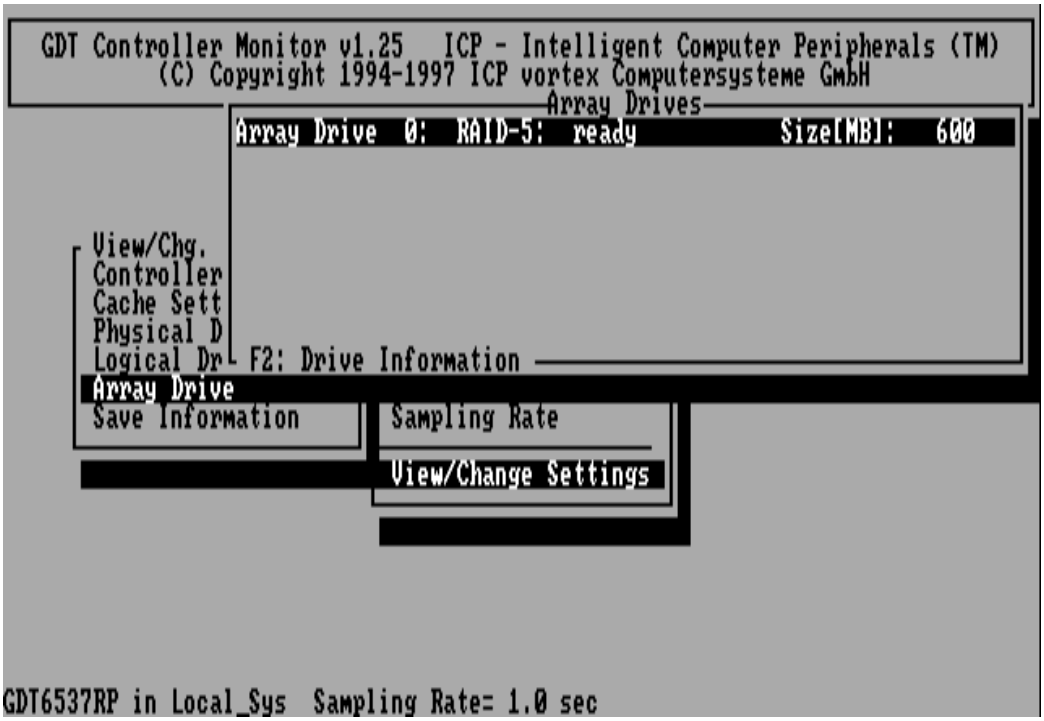
GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
(C) Copyright 1994-1997 ICP vortex Computersysteme GmbH
Array Drives
Array Drive 0: RAID-5: ready Size[MB]: 400
View/Chg.
Controller
Disk Drive Positions
No. Position Chn. ID Status Vendor Type Attr. Size[MB] Drive
0 PCI 0/9 A 0 i SEAGATE ST52160N RW 2068
1 PCI 0/9 B 0 i QUANTUM P105S 910-10-94x RW 99
2 PCI 0/9 C 4 i SEAGATE ST52160N RW 2068 Fragment
3 PCI 0/9 A 1
4 PCI 0/9 A 2
5 PCI 0/9 A 3
6 PCI 0/9 A 4
7 PCI 0/9 A 5
8 PCI 0/9 B 1
Select the position of the new disk drive
GDT6537RP in Local_Sys Sampling Rate= 1.0 sec


GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
(C) Copyright 1994-1997 ICP vortex Computersysteme GmbH
Array Drives
Array Drive 0: RAID-5: ready Size[MB]: 400
View/Chg.
Controller
Do you really want to add this drive to the array union ?
No
Yes
No. Position Chn. ID
Size[MB] Drive
0 PCI 0/9 A 0 2068
1 PCI 0/9 B 0 99
2 PCI 0/9 C 4 2068 Fragment
3 PCI 0/9 A 1
4 PCI 0/9 A 2
5 PCI 0/9 A 3
6 PCI 0/9 A 4
7 PCI 0/9 A 5
8 PCI 0/9 B 1
GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

The new drive is built into the Array Drive. According to the Expansion Progress Information this takes approximately 18 minutes. During the expansion the Array Drive's state is *ready/expand*.



As expected the Array Drive's capacity is now 600MB.



G.3.6.4 Pool Hot Fix Access

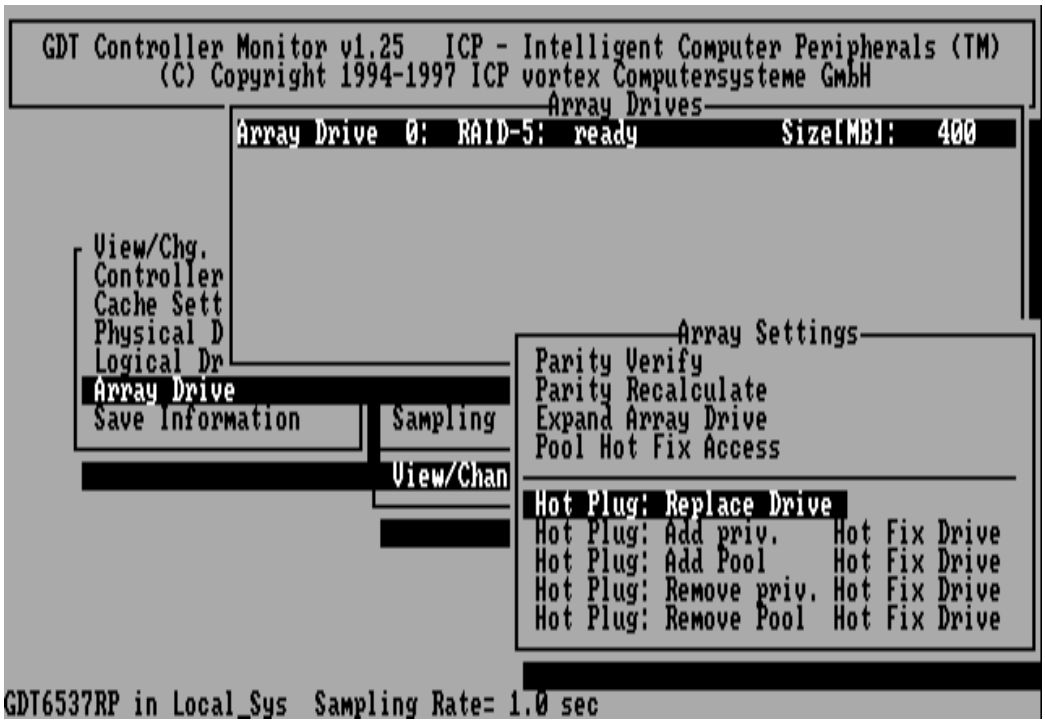
This function enables or disables the access of a certain RAID 4 or RAID 5 Array Drive to the Hot Fix Pool.

GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
(C) Copyright 1994-1997 ICP vortex Computersysteme GmbH
Array Drives
Array Drive 0: RAID-5: ready Size[MB]: 400
View/Chg.
Controll
Cache Se
Physical
Logical
Array Dr
Save Inf
The access to the Hot Fix Pool is enabled !
Do you want to disable it ?
No
Yes
View/Chan
Hot Plug: Replace Drive
Hot Plug: Add priv. Hot Fix Drive
Hot Plug: Add Pool Hot Fix Drive
Hot Plug: Remove priv. Hot Fix Drive
Hot Plug: Remove Pool Hot Fix Drive
GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

If the access had been enabled before, you would be able to disable it now.

G.3.6.5 Hot Plug: Replace Drive

In a similar way as was described a few pages before with the RAID 1 Array Drives, this function is designed to replace a defective drive of a RAID 4 or RAID 5 Array Drive, while the system continues to be fully operational.



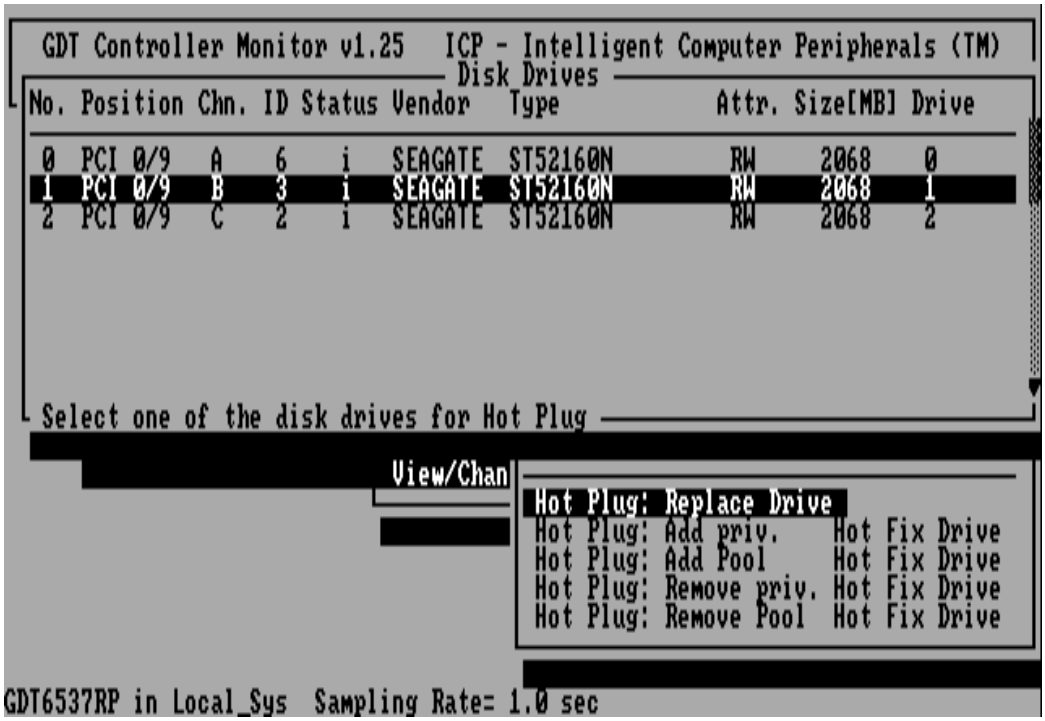
There are typically two different applications where a Hot Plug is necessary.

Application 1. The RAID 4/5 Array Drive is in the *ready* state.
It is likely that a drive will soon fail (for example when there is a loud operating noise). As a preventative measure, this drive ought to be exchanged now, that is, in a moment when the Array Drive is still in a ready state and still has redundancy.

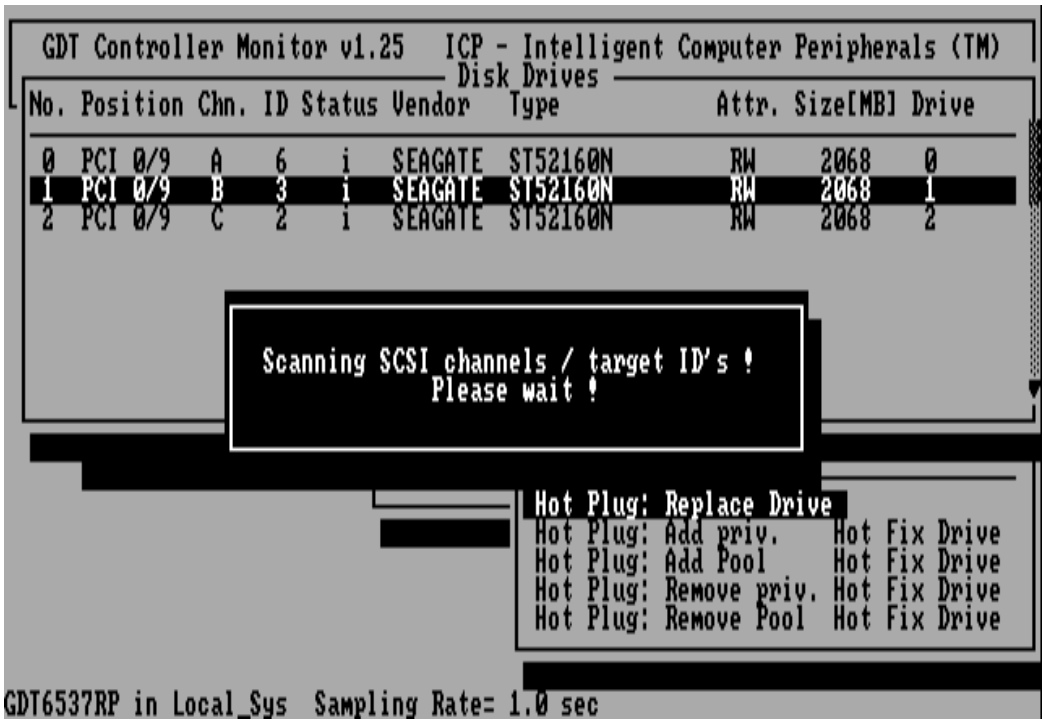
Application 2. The RAID 4/5 Array Drive is no longer fault tolerant (*fail* state), because a drive of the Array Drive has actually failed. The Array Drive is still fully operational, but it does not have redundancy any more. If another drive should also fail, the Array Drive's functionality is impaired.

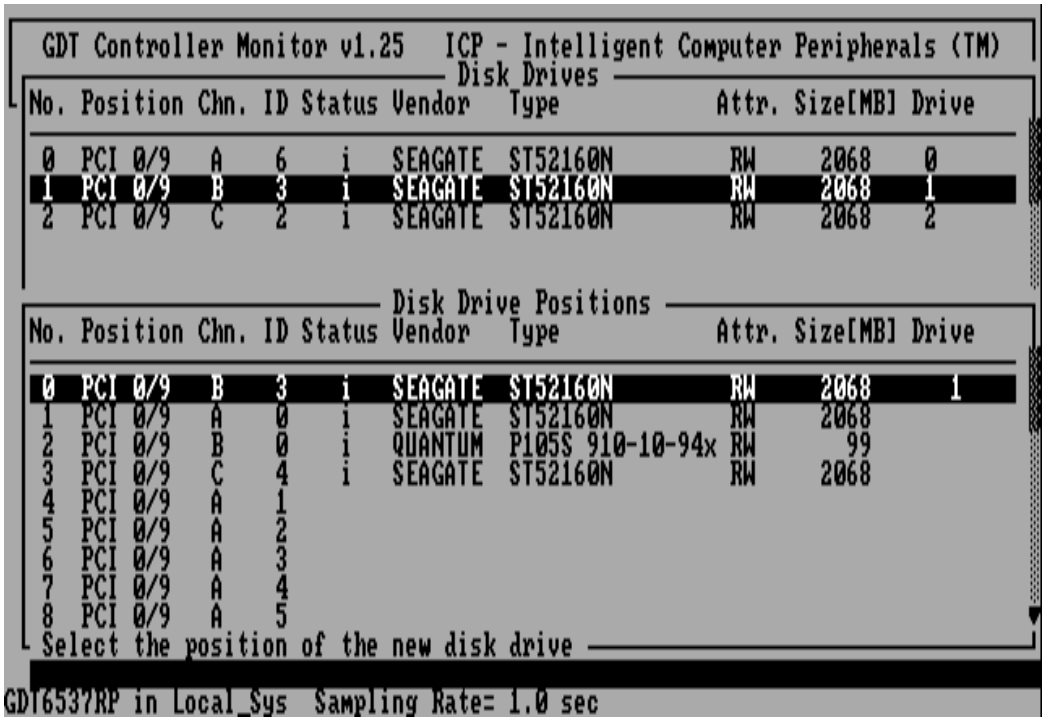
Example Session for Application 1

We assume that there is a RAID 5 Array Drive which is fault tolerant. Its state is *ready*, all drives are valid. After selecting the Array Drive, we choose the Replace Drive option.


GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
Disk Drives
No. Position Chn. ID Status Vendor Type Attr. Size[MB] Drive
0 PCI 0/9 A 6 i SEAGATE ST52160N RW 2068 0
1 PCI 0/9 B 3 i SEAGATE ST52160N RW 2068 1
2 PCI 0/9 C 2 i SEAGATE ST52160N RW 2068 2
Select one of the disk drives for Hot Plug
View/Chan
Hot Plug: Replace Drive
Hot Plug: Add priv. Hot Fix Drive
Hot Plug: Add Pool Hot Fix Drive
Hot Plug: Remove priv. Hot Fix Drive
Hot Plug: Remove Pool Hot Fix Drive
GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

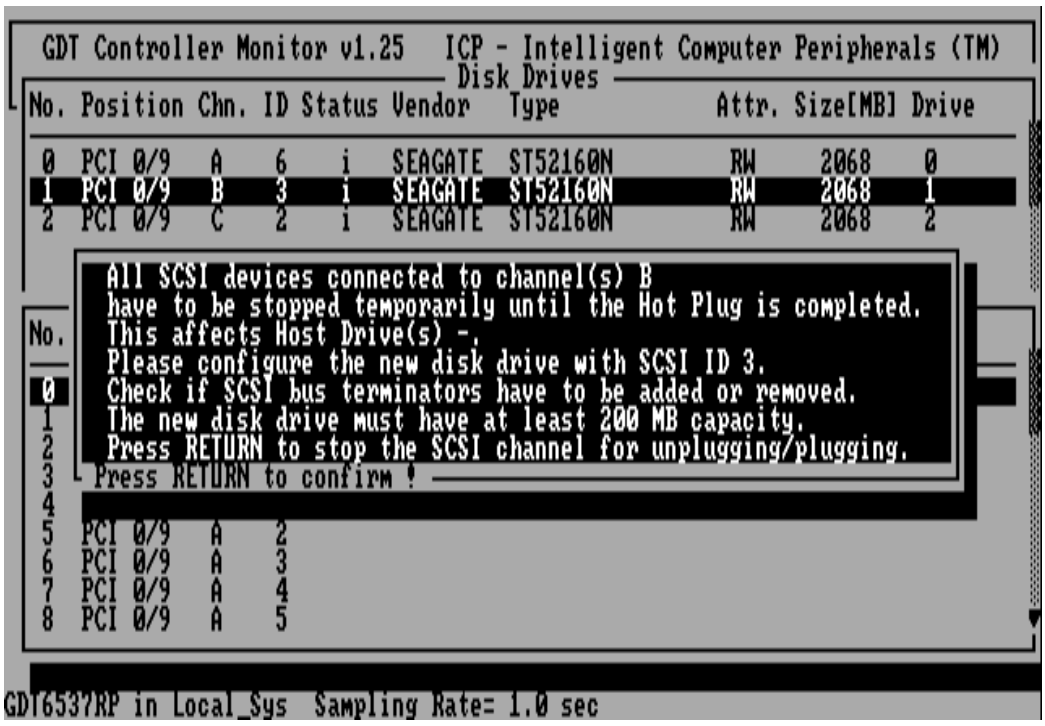
A list of the Array Drive's components is displayed. For our example we choose No.1 for the Hot Plug.
GDTMON scans the ICP Controller's I/O channels for drives which are still free (not yet assigned to Logical Drives) and free (i.e., not occupied) I/O channels and IDs.


GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
Disk Drives
No. Position Chn. ID Status Vendor Type Attr. Size[MB] Drive
0 PCI 0/9 A 6 i SEAGATE ST52160N RW 2068 0
1 PCI 0/9 B 3 i SEAGATE ST52160N RW 2068 1
2 PCI 0/9 C 2 i SEAGATE ST52160N RW 2068 2
Scanning SCSI channels / target ID's !
Please wait !
Hot Plug: Replace Drive
Hot Plug: Add priv. Hot Fix Drive
Hot Plug: Add Pool Hot Fix Drive
Hot Plug: Remove priv. Hot Fix Drive
Hot Plug: Remove Pool Hot Fix Drive
GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

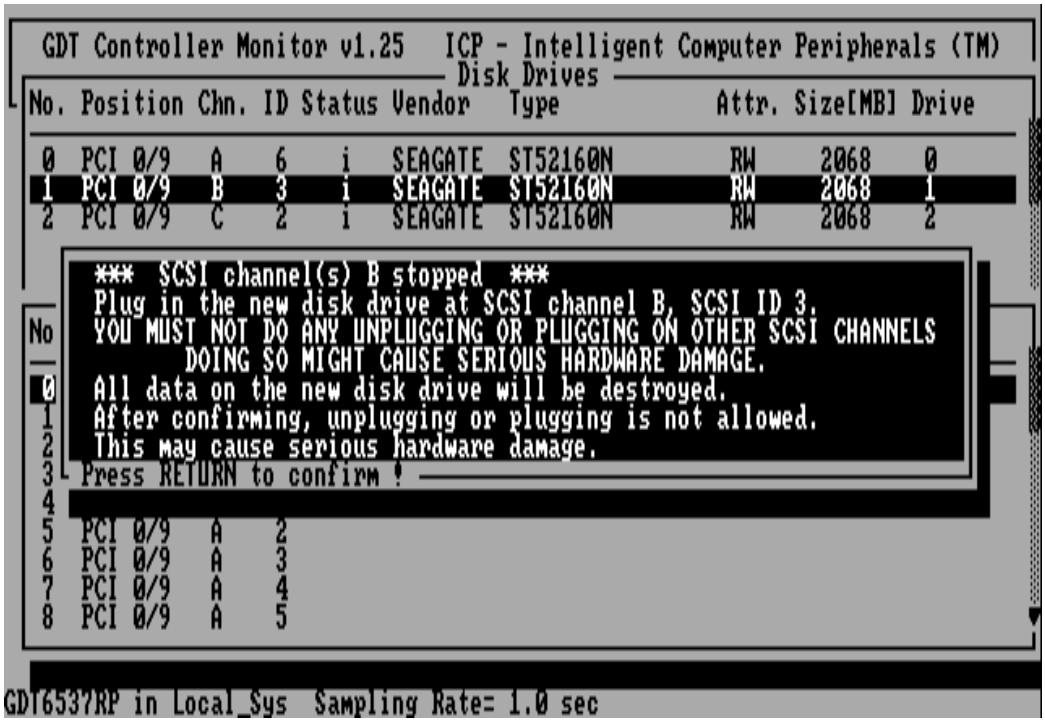

GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
Disk Drives
No. Position Chn. ID Status Vendor Type Attr. Size[MB] Drive
0 PCI 0/9 A 6 i SEAGATE ST52160N RW 2068 0
1 PCI 0/9 B 3 i SEAGATE ST52160N RW 2068 1
2 PCI 0/9 C 2 i SEAGATE ST52160N RW 2068 2
Disk Drive Positions
No. Position Chn. ID Status Vendor Type Attr. Size[MB] Drive
0 PCI 0/9 B 3 i SEAGATE ST52160N RW 2068 1
1 PCI 0/9 A 0 i SEAGATE ST52160N RW 2068
2 PCI 0/9 B 0 i QUANTUM P105S 910-10-94x RW 99
3 PCI 0/9 C 4 i SEAGATE ST52160N RW 2068
4 PCI 0/9 A 1
5 PCI 0/9 A 2
6 PCI 0/9 A 3
7 PCI 0/9 A 4
8 PCI 0/9 A 5
Select the position of the new disk drive
GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

The list of Disk Drive Positions shows us the following:

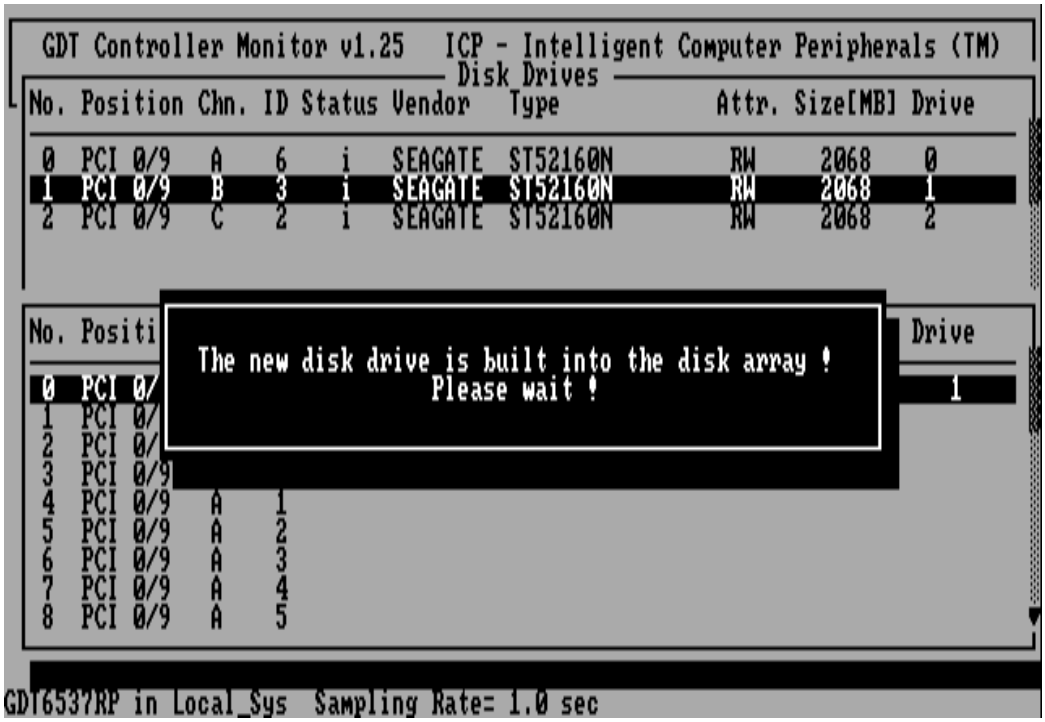
No.0	This is the position of the drive which should be replaced. Since it is still there, the hard disk's state, vendor, type, attributes, size and Logical Drive number are displayed.
No.1, 2, 3	Free available (i.e., not yet assigned to a Logical Drive) drives. 1 and 3 could also be used for the replacement.
No.4 to No.17	These are free (i.e., not occupied) plugging positions for the new hard disk (On the above screen you can't see positions No.9 to No.17, but you can scroll the list with the Page-Down/Up keys).


GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
Disk Drives
No. Position Chn. ID Status Vendor Type Attr. Size[MB] Drive
0 PCI 0/9 A 6 i SEAGATE ST52160N RW 2068 0
1 PCI 0/9 B 3 i SEAGATE ST52160N RW 2068 1
2 PCI 0/9 C 2 i SEAGATE ST52160N RW 2068 2
All SCSI devices connected to channel(s) B
have to be stopped temporarily until the Hot Plug is completed.
This affects Host Drive(s) -.
Please configure the new disk drive with SCSI ID 3.
Check if SCSI bus terminators have to be added or removed.
The new disk drive must have at least 200 MB capacity.
Press RETURN to stop the SCSI channel for unplugging/plugging.
Press RETURN to confirm !
No.
0
1
2
3
4
5 PCI 0/9 A 2
6 PCI 0/9 A 3
7 PCI 0/9 A 4
8 PCI 0/9 A 5
GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

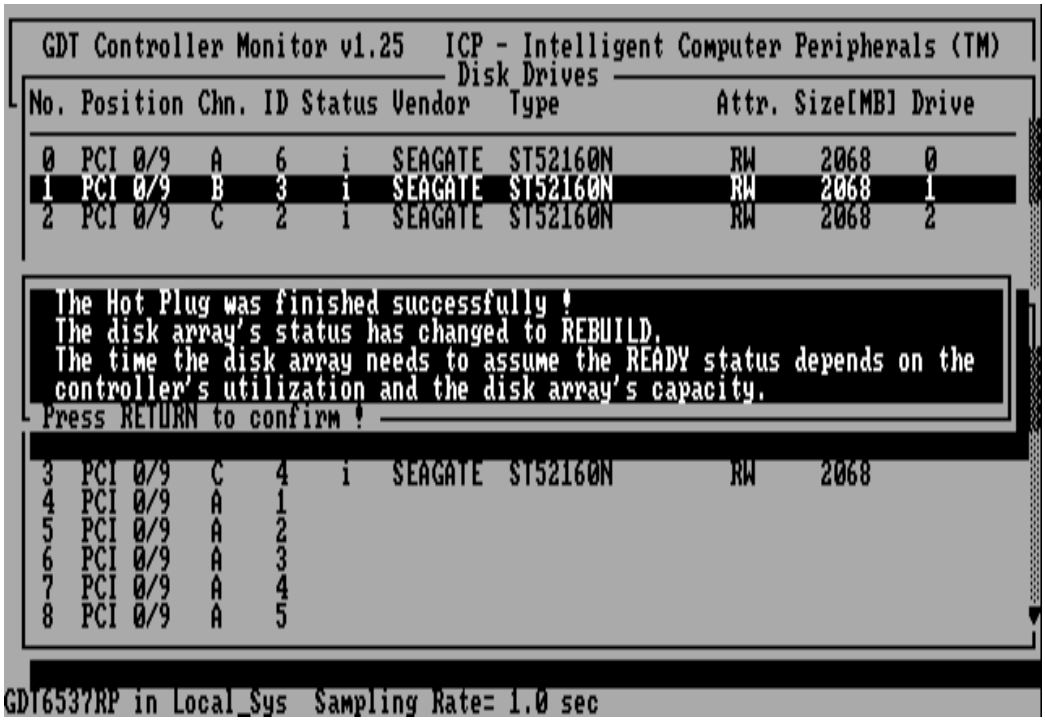
For our example we now take the new hard disk (which must have a capacity equal or larger than 200MB) set it to SCSI ID 3 and observe the SCSI termination.


GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
Disk Drives
No. Position Chn. ID Status Vendor Type Attr. Size[MB] Drive
0 PCI 0/9 A 6 i SEAGATE ST52160N RW 2068 0
1 PCI 0/9 B 3 i SEAGATE ST52160N RW 2068 1
2 PCI 0/9 C 2 i SEAGATE ST52160N RW 2068 2
*** SCSI channel(s) B stopped ***
Plug in the new disk drive at SCSI channel B, SCSI ID 3.
YOU MUST NOT DO ANY UNPLUGGING OR PLUGGING ON OTHER SCSI CHANNELS
DOING SO MIGHT CAUSE SERIOUS HARDWARE DAMAGE.
All data on the new disk drive will be destroyed.
After confirming, unplugging or plugging is not allowed.
This may cause serious hardware damage.
Press RETURN to confirm !
GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

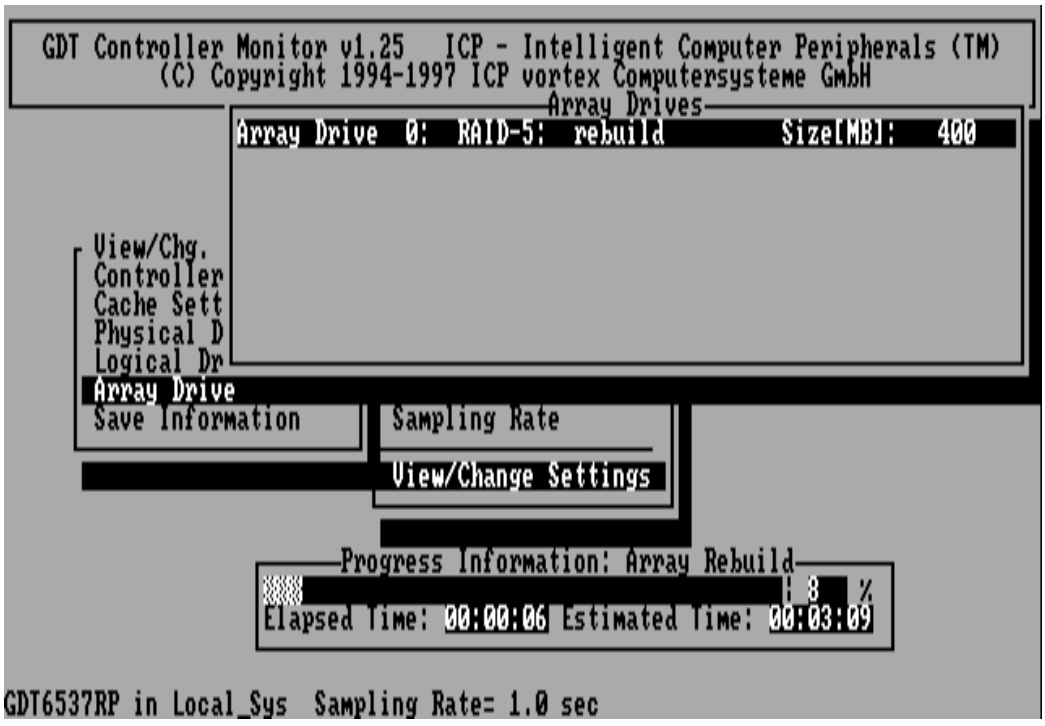
After this message we can unplug the old drive and plug in the new one again and confirm this procedure.


GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
Disk Drives
No. Position Chn. ID Status Vendor Type Attr. Size[MB] Drive
0 PCI 0/9 A 6 i SEAGATE ST52160N RW 2068 0
1 PCI 0/9 B 3 i SEAGATE ST52160N RW 2068 1
2 PCI 0/9 C 2 i SEAGATE ST52160N RW 2068 2
The new disk drive is built into the disk array !
Please wait !
GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

If everything was OK, GDTMON displays the following message:

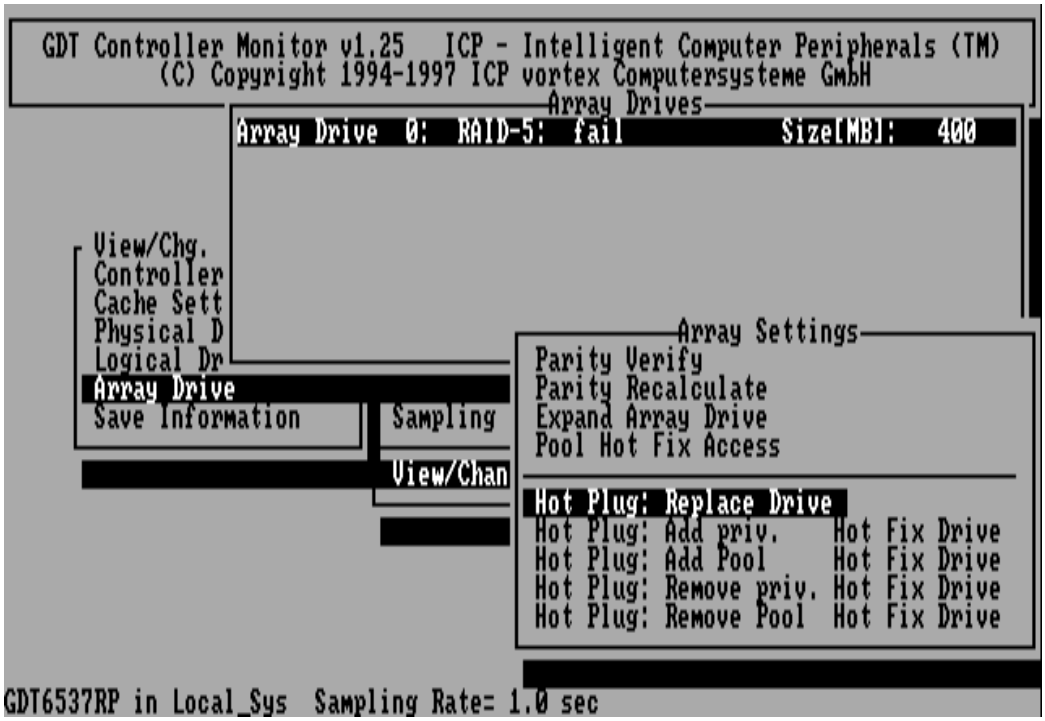

GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
Disk Drives
No. Position Chn. ID Status Vendor Type Attr. Size[MB] Drive
0 PCI 0/9 A 6 i SEAGATE ST52160N RW 2068 0
1 PCI 0/9 B 3 i SEAGATE ST52160N RW 2068 1
2 PCI 0/9 C 2 i SEAGATE ST52160N RW 2068 2
The Hot Plug was finished successfully !
The disk array's status has changed to REBUILD.
The time the disk array needs to assume the READY status depends on the controller's utilization and the disk array's capacity.
Press RETURN to confirm !
3 PCI 0/9 C 4 i SEAGATE ST52160N RW 2068
4 PCI 0/9 A 1
5 PCI 0/9 A 2
6 PCI 0/9 A 3
7 PCI 0/9 A 4
8 PCI 0/9 A 5
GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

If the new drive, which we have plugged in just before, had contained data from a previous operation with a ICP Controller, GDTMON would have reported this.

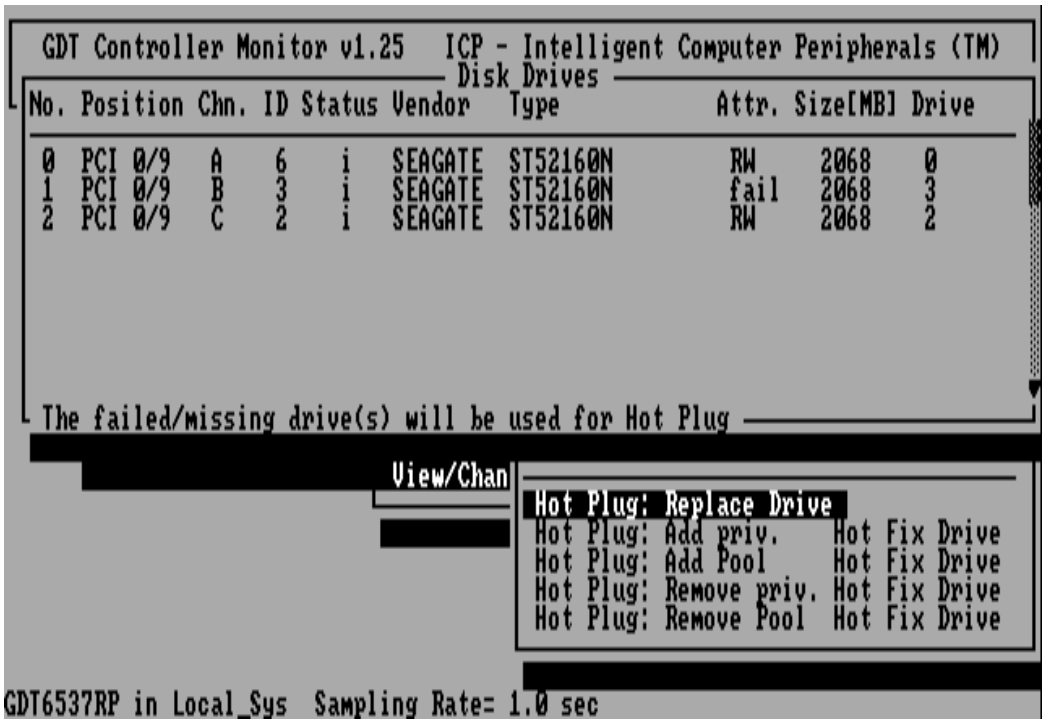


Example Session for Application 2

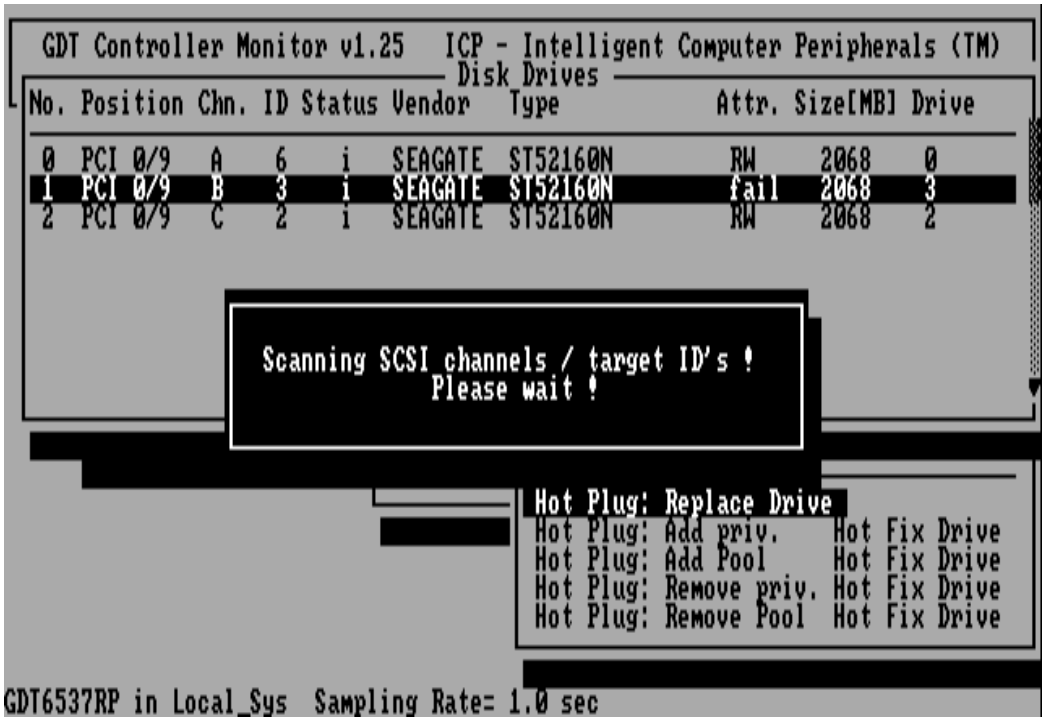
We assume that there is a RAID 5 Array Drive where one drive has failed. Its state is *fail*. After selecting the Array Drive, we choose the Replace Drive option.

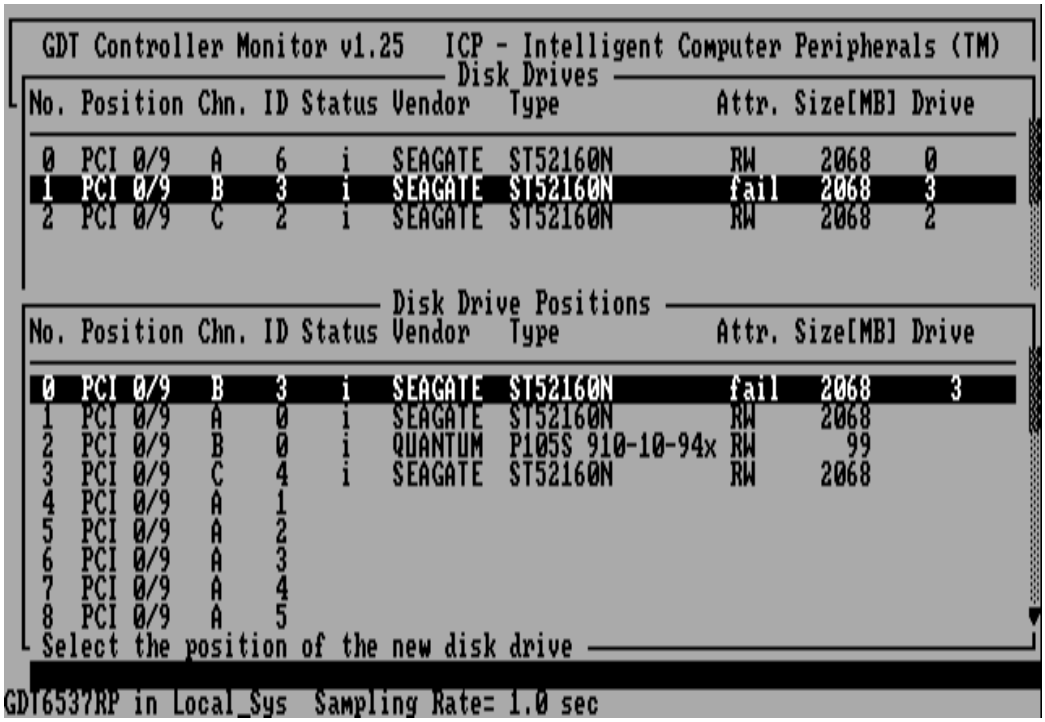


GDTMON shows the failed drive (No.1),


GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
Disk Drives
No. Position Chn. ID Status Vendor Type Attr. Size[MB] Drive
0 PCI 0/9 A 6 i SEAGATE ST52160N RW 2068 0
1 PCI 0/9 B 3 i SEAGATE ST52160N fail 2068 3
2 PCI 0/9 C 2 i SEAGATE ST52160N RW 2068 2
The failed/missing drive(s) will be used for Hot Plug
View/Chan
Hot Plug: Replace Drive
Hot Plug: Add priv. Hot Fix Drive
Hot Plug: Add Pool Hot Fix Drive
Hot Plug: Remove priv. Hot Fix Drive
Hot Plug: Remove Pool Hot Fix Drive
GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

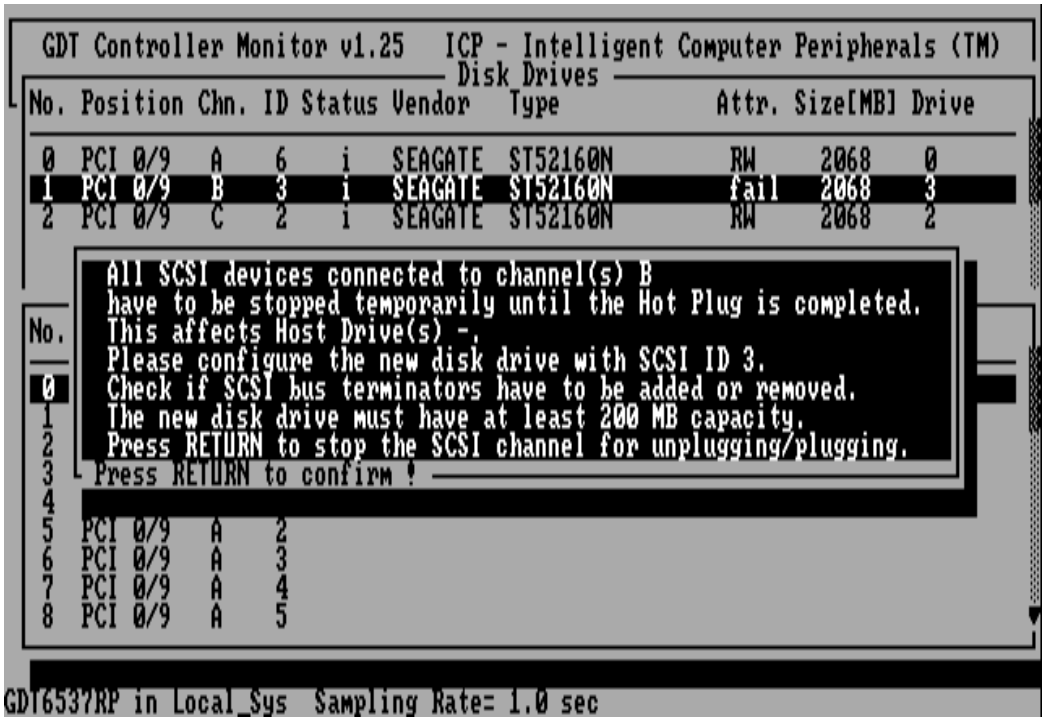
After pressing the <ENTER>-key, GDTMON scans the ICP Controller for free plugging positions:


GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
Disk Drives
No. Position Chn. ID Status Vendor Type Attr. Size[MB] Drive
0 PCI 0/9 A 6 i SEAGATE ST52160N RW 2068 0
1 PCI 0/9 B 3 i SEAGATE ST52160N fail 2068 3
2 PCI 0/9 C 2 i SEAGATE ST52160N RW 2068 2
Scanning SCSI channels / target ID's !
Please wait !
Hot Plug: Replace Drive
Hot Plug: Add priv. Hot Fix Drive
Hot Plug: Add Pool Hot Fix Drive
Hot Plug: Remove priv. Hot Fix Drive
Hot Plug: Remove Pool Hot Fix Drive
GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

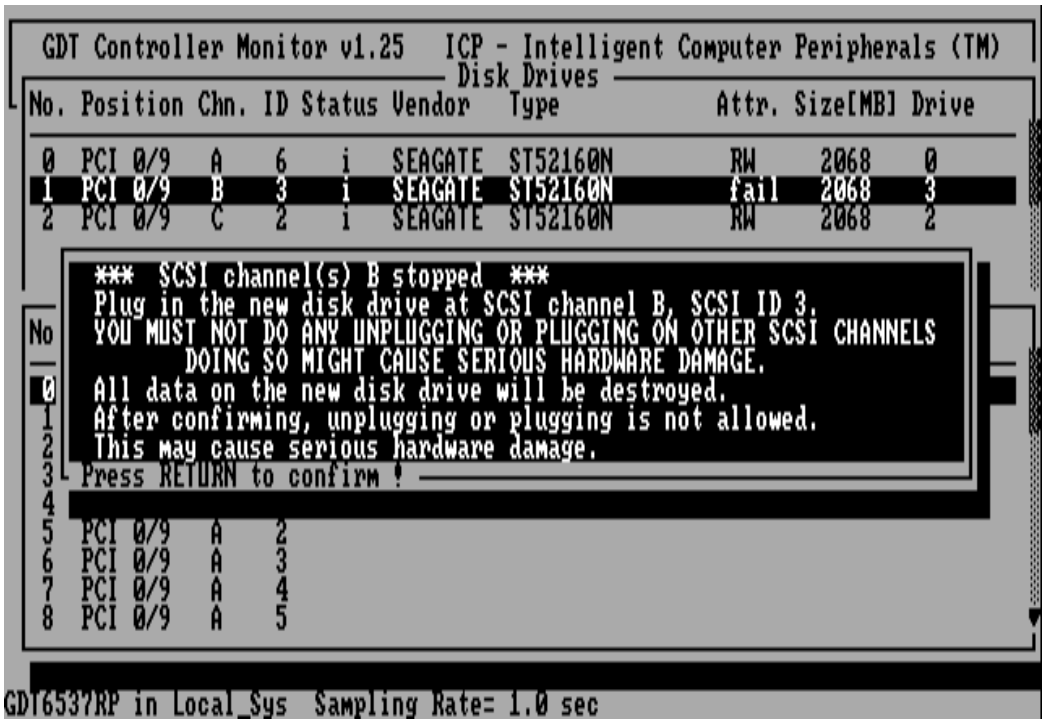

GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
Disk Drives
No. Position Chn. ID Status Vendor Type Attr. Size[MB] Drive
0 PCI 0/9 A 6 i SEAGATE ST52160N RW 2068 0
1 PCI 0/9 B 3 i SEAGATE ST52160N fail 2068 3
2 PCI 0/9 C 2 i SEAGATE ST52160N RW 2068 2
Disk Drive Positions
No. Position Chn. ID Status Vendor Type Attr. Size[MB] Drive
0 PCI 0/9 B 3 i SEAGATE ST52160N fail 2068 3
1 PCI 0/9 A 0 i SEAGATE ST52160N RW 2068
2 PCI 0/9 B 0 i QUANTUM P105S 910-10-94x RW 99
3 PCI 0/9 C 4 i SEAGATE ST52160N RW 2068
4 PCI 0/9 A 1
5 PCI 0/9 A 2
6 PCI 0/9 A 3
7 PCI 0/9 A 4
8 PCI 0/9 A 5
Select the position of the new disk drive
GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

The list of Disk Drive Positions shows us the following:

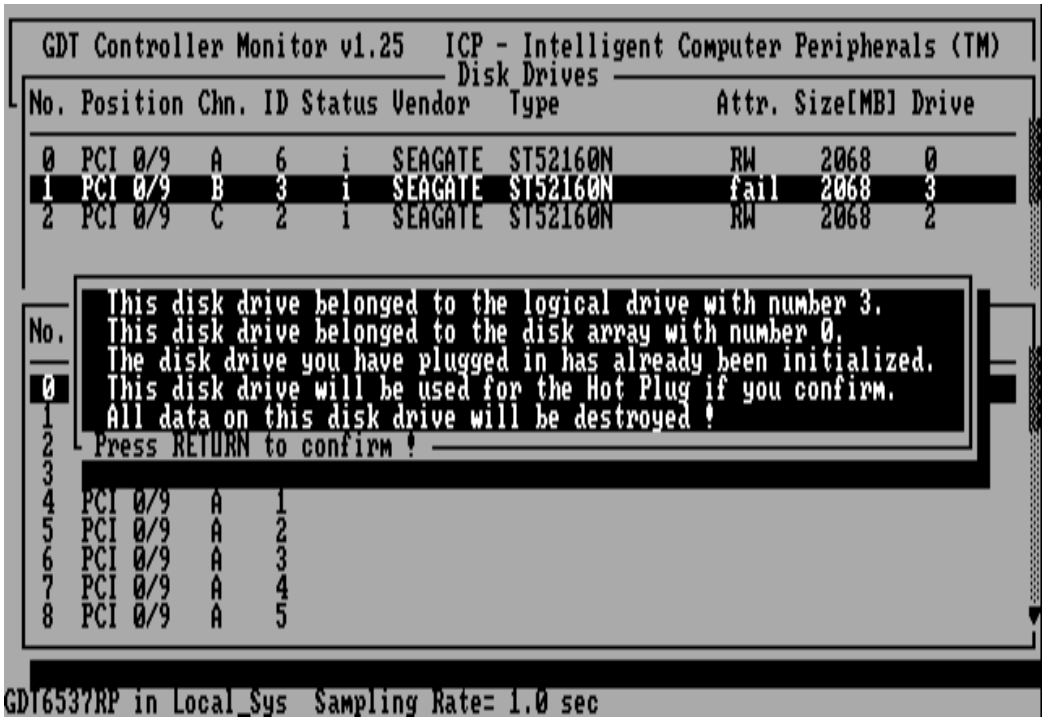
No.0	This is the position of the drive which should be replaced. Since it is still there, but defective, the hard disk's state, vendor, type, attributes, size and Logical Drive number are displayed.
No.1, 2, 3	Free available (i.e., not yet assigned to a Logical Drive) drives. 1 and 3 could also be used for the replacement.
No.4 to No.17	These are free (i.e., not occupied) plugging positions for the new hard disk (On the above screen you can't see positions No.9 to No.17, but you can scroll the list with the Page-Down/Up keys).


GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
Disk Drives
No. Position Chn. ID Status Vendor Type Attr. Size[MB] Drive
0 PCI 0/9 A 6 i SEAGATE ST52160N RW 2068 0
1 PCI 0/9 B 3 i SEAGATE ST52160N fail 2068 3
2 PCI 0/9 C 2 i SEAGATE ST52160N RW 2068 2
All SCSI devices connected to channel(s) B
have to be stopped temporarily until the Hot Plug is completed.
This affects Host Drive(s) -.
Please configure the new disk drive with SCSI ID 3.
Check if SCSI bus terminators have to be added or removed.
The new disk drive must have at least 200 MB capacity.
Press RETURN to stop the SCSI channel for unplugging/plugging.
Press RETURN to confirm !
GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

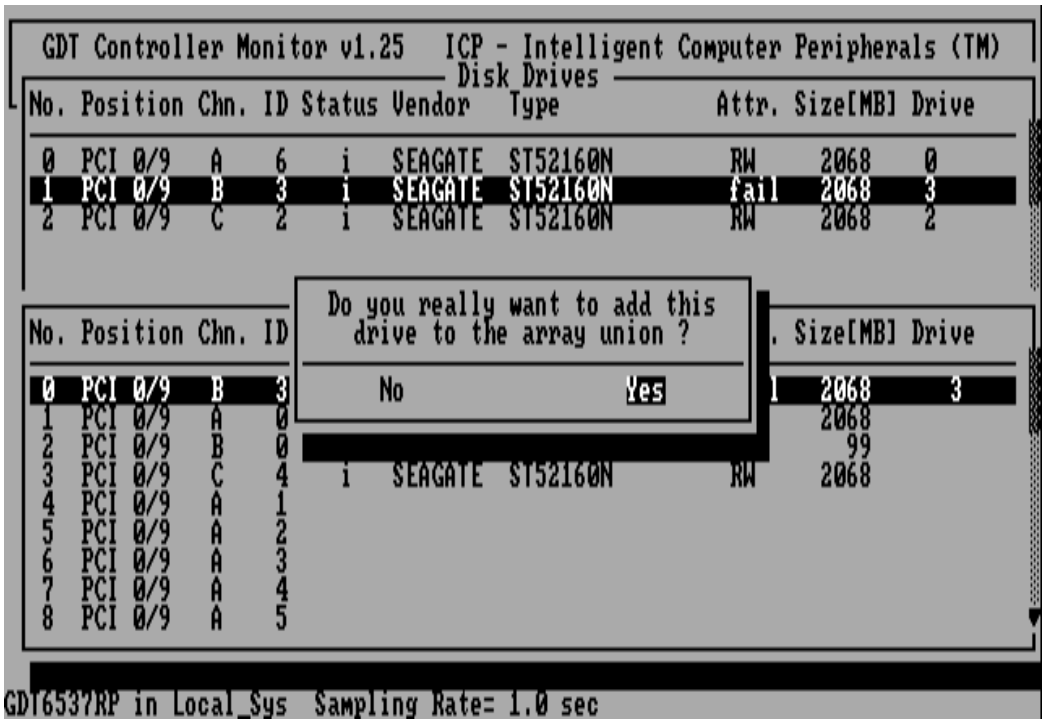
For our example we now take the new hard disk (which must have a capacity equal to or larger than 200MB) set it to SCSI ID 3 and observe the SCSI termination.


GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
Disk Drives
No. Position Chn. ID Status Vendor Type Attr. Size[MB] Drive
0 PCI 0/9 A 6 i SEAGATE ST52160N RW 2068 0
1 PCI 0/9 B 3 i SEAGATE ST52160N fail 2068 3
2 PCI 0/9 C 2 i SEAGATE ST52160N RW 2068 2
*** SCSI channel(s) B stopped ***
Plug in the new disk drive at SCSI channel B, SCSI ID 3.
YOU MUST NOT DO ANY UNPLUGGING OR PLUGGING ON OTHER SCSI CHANNELS
DOING SO MIGHT CAUSE SERIOUS HARDWARE DAMAGE.
All data on the new disk drive will be destroyed.
After confirming, unplugging or plugging is not allowed.
This may cause serious hardware damage.
Press RETURN to confirm !
GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

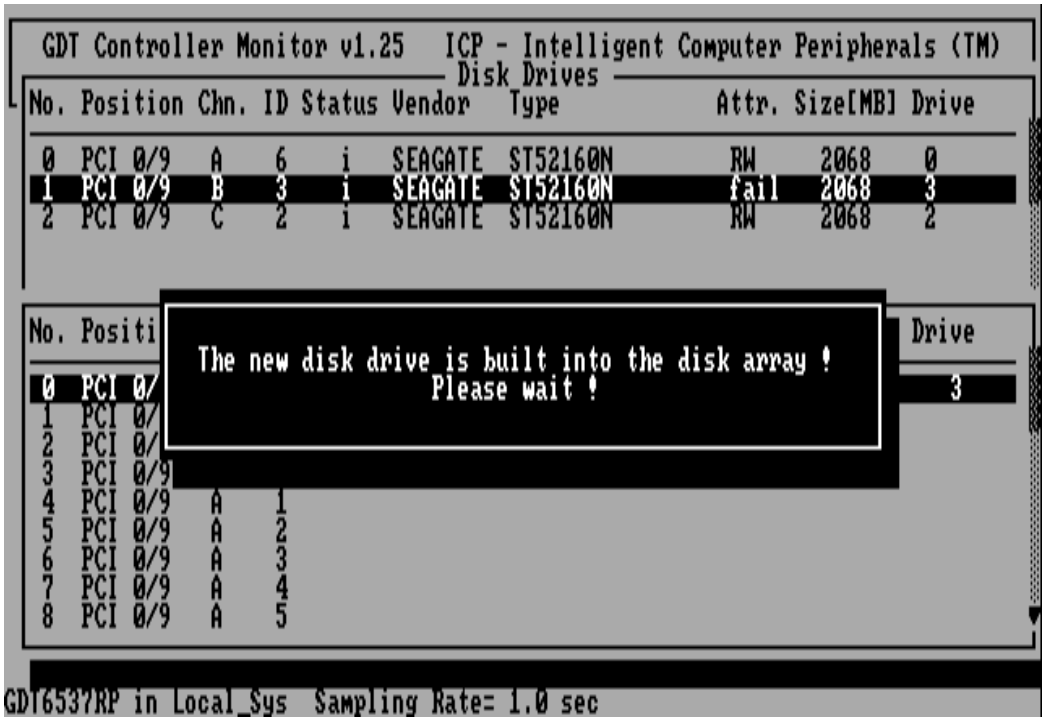
After this message we can unplug the old drive and plug the new one in again and confirm this procedure.

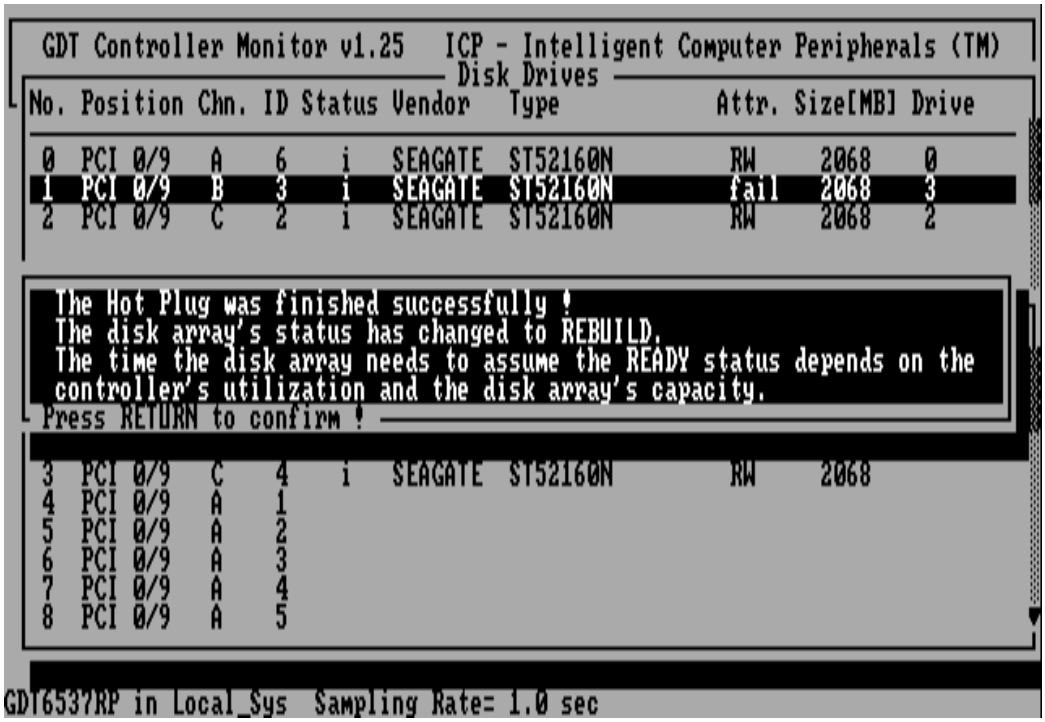

GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
Disk Drives
No. Position Chn. ID Status Vendor Type Attr. Size[MB] Drive
0 PCI 0/9 A 6 i SEAGATE ST52160N RW 2068 0
1 PCI 0/9 B 3 i SEAGATE ST52160N fail 2068 3
2 PCI 0/9 C 2 i SEAGATE ST52160N RW 2068 2
This disk drive belonged to the logical drive with number 3.
This disk drive belonged to the disk array with number 0.
The disk drive you have plugged in has already been initialized.
This disk drive will be used for the Hot Plug if you confirm.
All data on this disk drive will be destroyed !
Press RETURN to confirm !
GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

GDTMON has detected data on the new drive (i.e., it was already used as a Logical Drive with a ICP Controller).

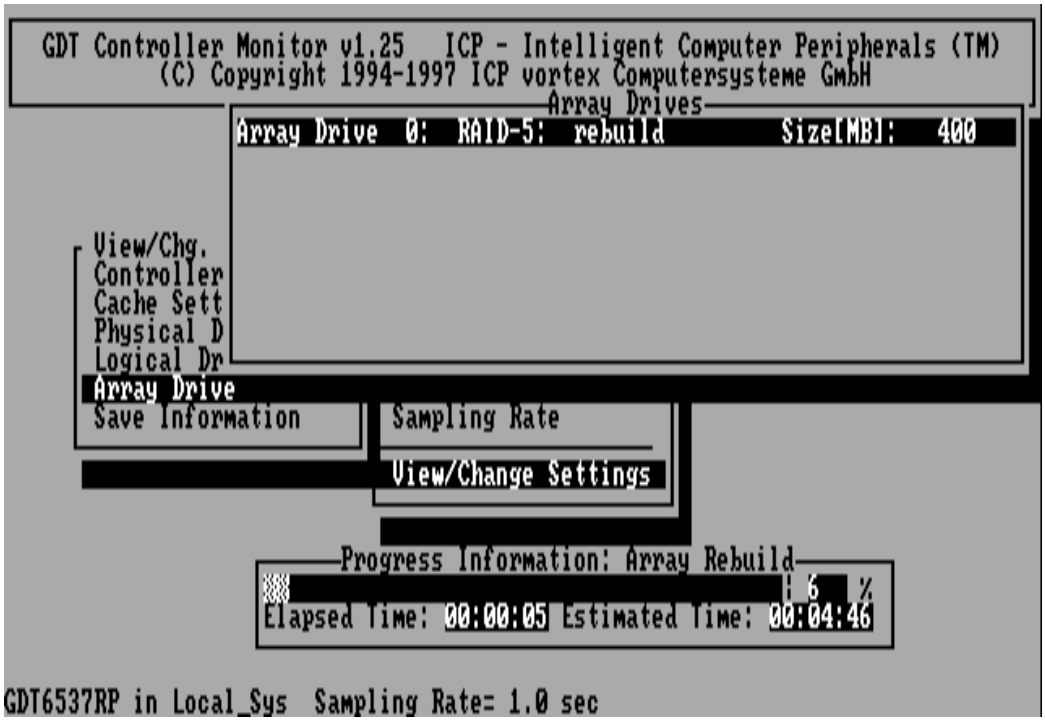

GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
Disk Drives
No. Position Chn. ID Status Vendor Type Attr. Size[MB] Drive
0 PCI 0/9 A 6 i SEAGATE ST52160N RW 2068 0
1 PCI 0/9 B 3 i SEAGATE ST52160N fail 2068 3
2 PCI 0/9 C 2 i SEAGATE ST52160N RW 2068 2
Do you really want to add this drive to the array union ?
No Yes
GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

This confirmation deletes all data on the new drive and prepares it for the Array Drive.


GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
Disk Drives
No. Position Chn. ID Status Vendor Type Attr. Size[MB] Drive
0 PCI 0/9 A 6 i SEAGATE ST52160N RW 2068 0
1 PCI 0/9 B 3 i SEAGATE ST52160N fail 2068 3
2 PCI 0/9 C 2 i SEAGATE ST52160N RW 2068 2
The new disk drive is built into the disk array !
Please wait !
Drive
3
GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

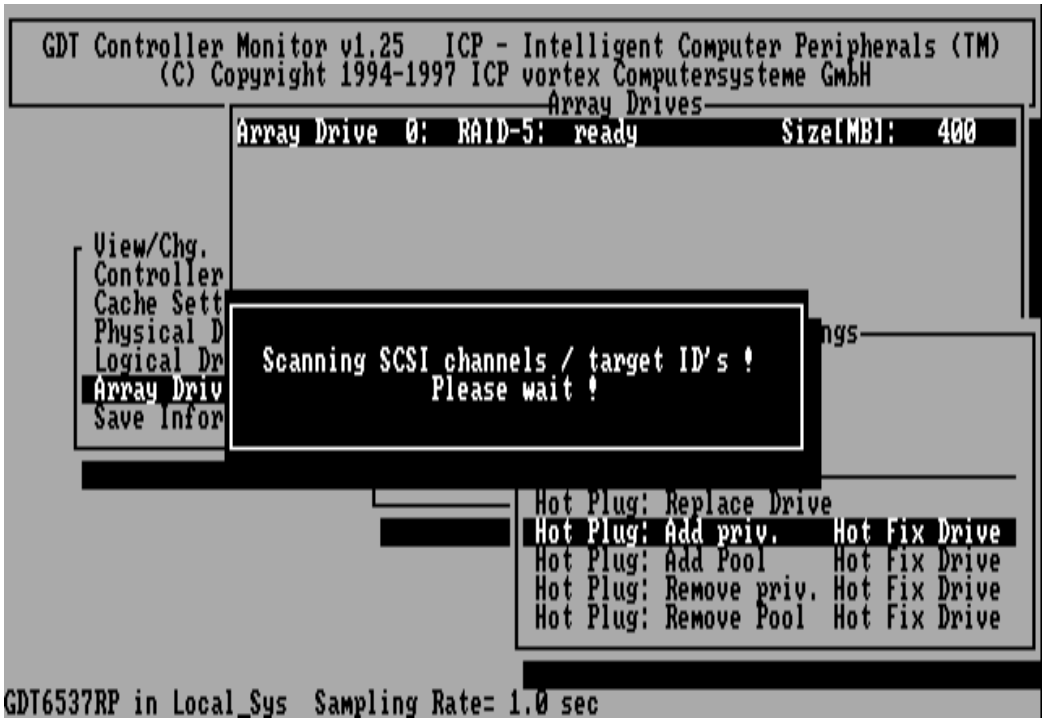

GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
Disk Drives
No. Position Chn. ID Status Vendor Type Attr. Size[MB] Drive
0 PCI 0/9 A 6 i SEAGATE ST52160N RW 2068 0
1 PCI 0/9 B 3 i SEAGATE ST52160N fail 2068 3
2 PCI 0/9 C 2 i SEAGATE ST52160N RW 2068 2
The Hot Plug was finished successfully !
The disk array's status has changed to REBUILD.
The time the disk array needs to assume the READY status depends on the
controller's utilization and the disk array's capacity.
Press RETURN to confirm !
GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

The Array Drive changes its state to *rebuild*. This means that the ICP Controller rebuilds the original data on the new drive.

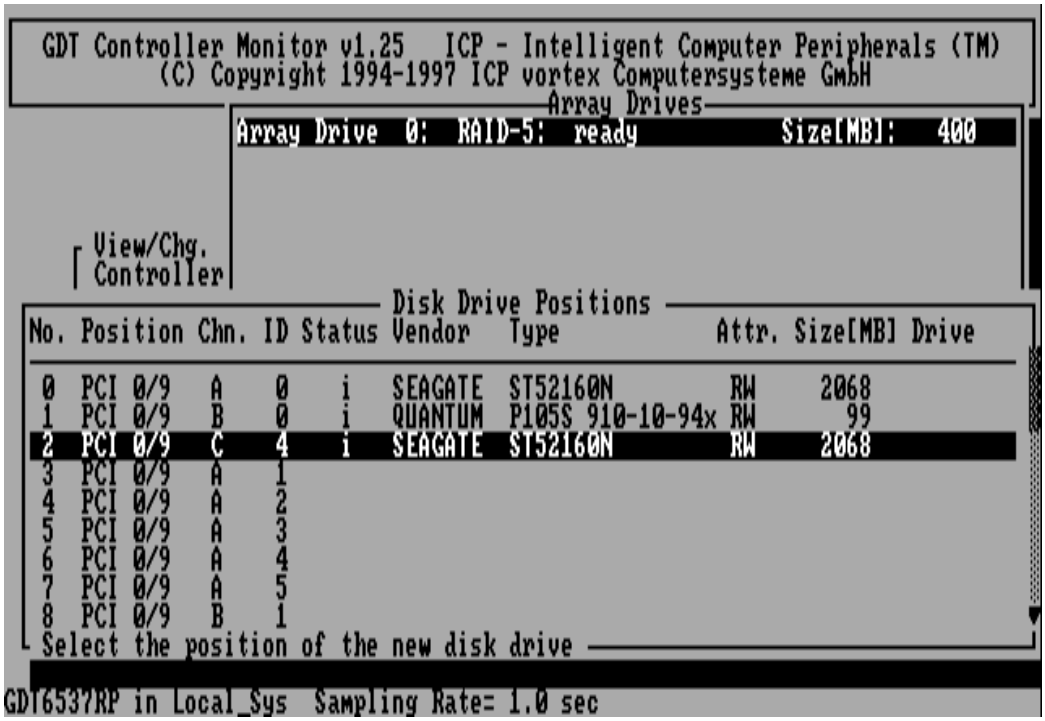


G.3.6.6 Hot Plug: Add private Hot Fix Drive

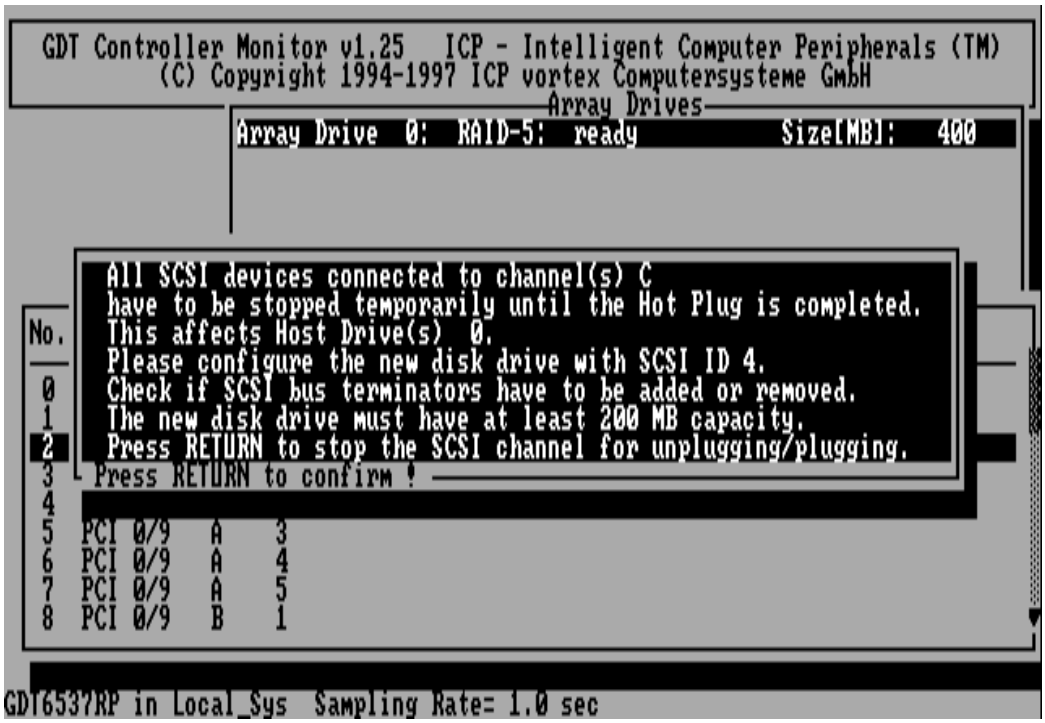
This function allows you to add a Hot Fix Drive to an existing RAID 4 / RAID 5 Array Drive. "Private" means that this Hot Fix Drive is only available for the selected Array Drive and cannot be accessed from other Array Drives.


GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
(C) Copyright 1994-1997 ICP vortex Computersysteme GmbH
Array Drives
Array Drive 0: RAID-5: ready Size[MB]: 400
View/Chg.
Controller
Cache Sett
Physical D
Logical Dr
Array Driv
Save Infor
Scanning SCSI channels / target ID's !
Please wait !
Hot Plug: Replace Drive
Hot Plug: Add priv. Hot Fix Drive
Hot Plug: Add Pool Hot Fix Drive
Hot Plug: Remove priv. Hot Fix Drive
Hot Plug: Remove Pool Hot Fix Drive
GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

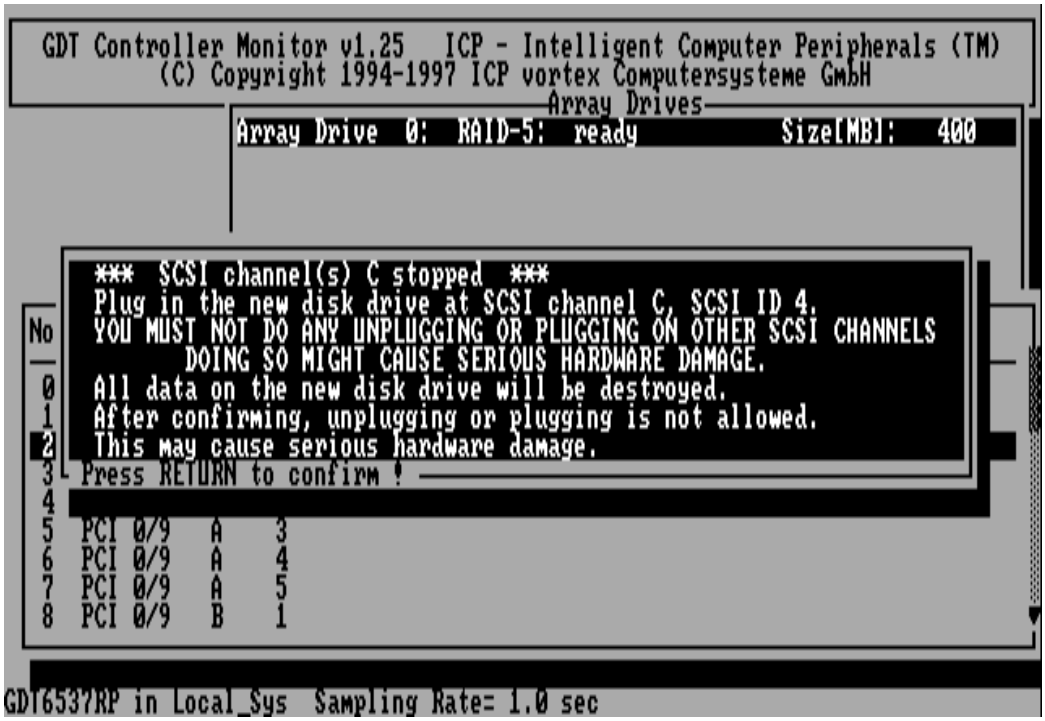
After selecting this option GDTMON scans the ICP Controller for free positions where the new Hot Fix Drive can be plugged in.


GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
(C) Copyright 1994-1997 ICP vortex Computersysteme GmbH
Array Drives
Array Drive 0: RAID-5: ready Size[MB]: 400
View/Chg. Controller
Disk Drive Positions
No. Position Chn. ID Status Vendor Type Attr. Size[MB] Drive
0 PCI 0/9 A 0 i SEAGATE ST52160N RW 2068
1 PCI 0/9 B 0 i QUANTUM P105S 910-10-94x RW 99
2 PCI 0/9 C 4 i SEAGATE ST52160N RW 2068
3 PCI 0/9 A 1
4 PCI 0/9 A 2
5 PCI 0/9 A 3
6 PCI 0/9 A 4
7 PCI 0/9 A 5
8 PCI 0/9 B 1
Select the position of the new disk drive
GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

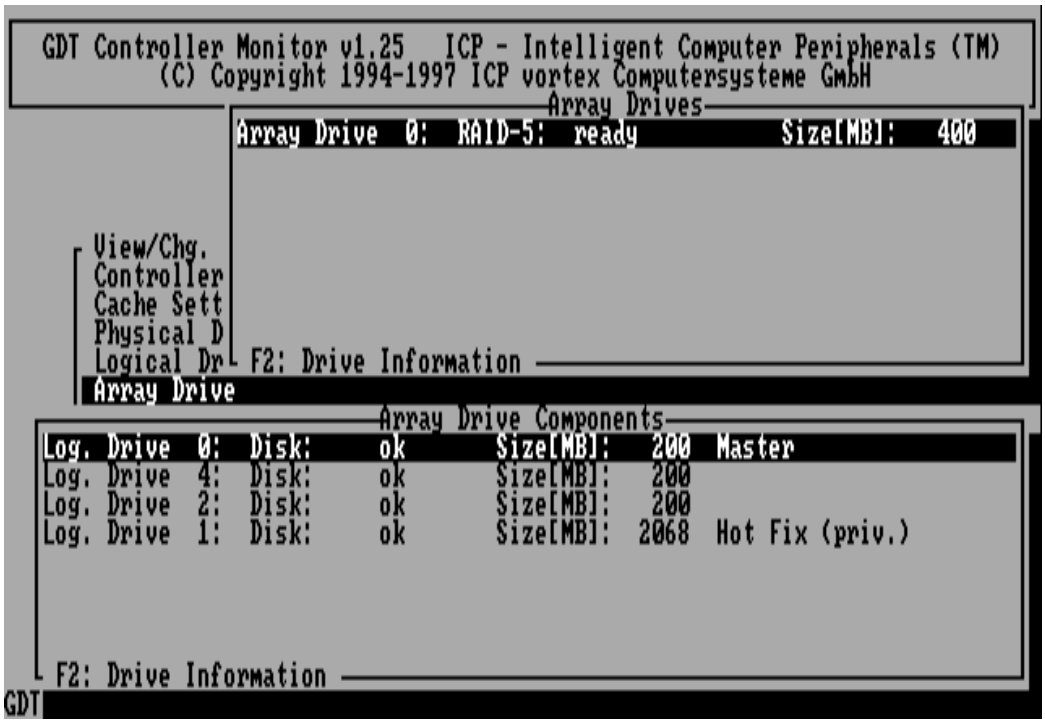
For our example, we choose the drive on Channel C and SCSI ID 4. (If we would plug in now a new drive we would have to set the SCSI ID to 4 and make sure that the SCSI termination is set properly).


GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
(C) Copyright 1994-1997 ICP vortex Computersysteme GmbH
Array Drives
Array Drive 0: RAID-5: ready Size[MB]: 400
All SCSI devices connected to channel(s) C
have to be stopped temporarily until the Hot Plug is completed.
This affects Host Drive(s) 0.
Please configure the new disk drive with SCSI ID 4.
Check if SCSI bus terminators have to be added or removed.
The new disk drive must have at least 200 MB capacity.
Press RETURN to stop the SCSI channel for unplugging/plugging.
Press RETURN to confirm !
No.
0
1
2
3
4
5 PCI 0/9 A 3
6 PCI 0/9 A 4
7 PCI 0/9 A 5
8 PCI 0/9 B 1
GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

GDTMON adds the new drive to the selected Array Drive.

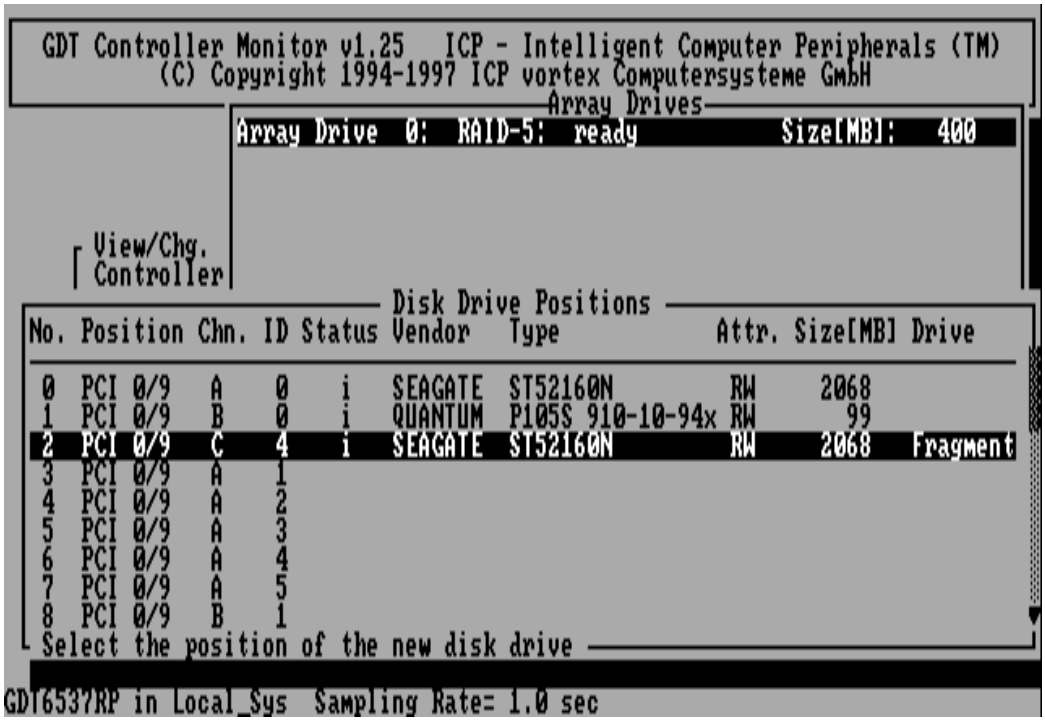

GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
(C) Copyright 1994-1997 ICP vortex Computersysteme GmbH
Array Drives
Array Drive 0: RAID-5: ready Size[MB]: 400
*** SCSI channel(s) C stopped ***
Plug in the new disk drive at SCSI channel C, SCSI ID 4.
YOU MUST NOT DO ANY UNPLUGGING OR PLUGGING ON OTHER SCSI CHANNELS
DOING SO MIGHT CAUSE SERIOUS HARDWARE DAMAGE.
All data on the new disk drive will be destroyed.
After confirming, unplugging or plugging is not allowed.
This may cause serious hardware damage.
Press RETURN to confirm !
No
0
1
2
3
4
5 PCI 0/9 A 3
6 PCI 0/9 A 4
7 PCI 0/9 A 5
8 PCI 0/9 B 1
GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

If we now look at the Array Drive's structure (press <F2>), we can see the new drive added as a Hot Fix Drive to the Array Drive.

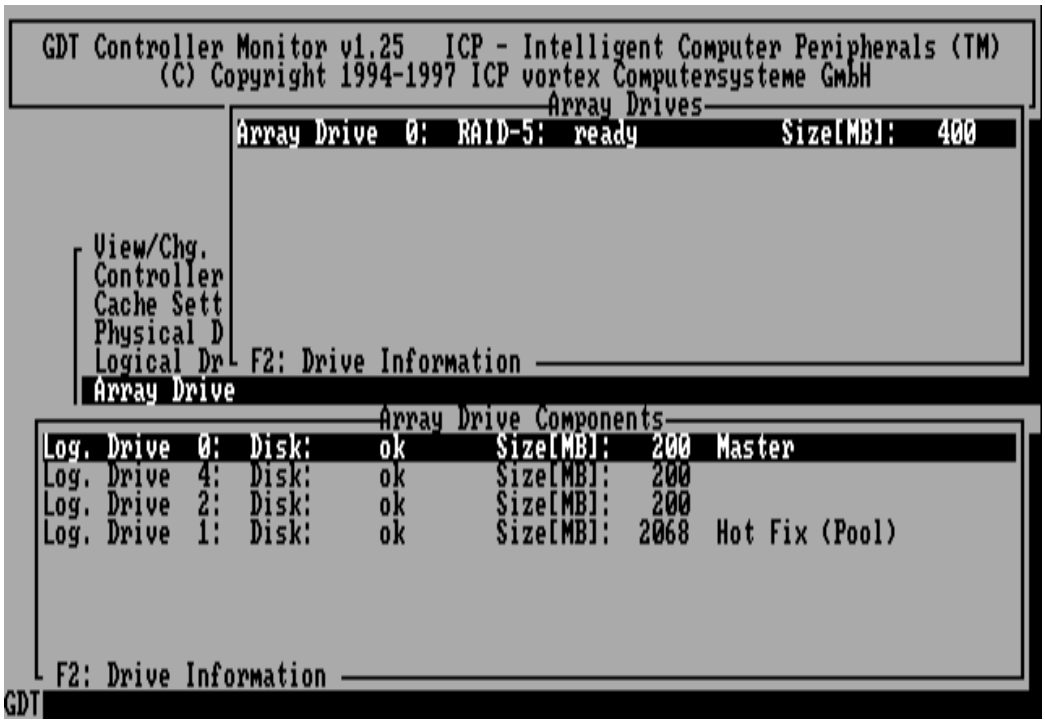

GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
(C) Copyright 1994-1997 ICP vortex Computersysteme GmbH
Array Drives
Array Drive 0: RAID-5: ready Size[MB]: 400
View/Chg.
Controller
Cache Sett
Physical D
Logical Dr
Array Drive
F2: Drive Information
Array Drive Components
Log. Drive 0: Disk: ok Size[MB]: 200 Master
Log. Drive 4: Disk: ok Size[MB]: 200
Log. Drive 2: Disk: ok Size[MB]: 200
Log. Drive 1: Disk: ok Size[MB]: 2068 Hot Fix (priv.)
F2: Drive Information
GDT

G.3.6.7 Hot Plug: Add Pool Hot Fix Drive

A Pool Hot Fix Drive is a spare drive within the so-called Hot Fix Pool. A drive in a Hot Fix Pool is available for several RAID 4/5 Array Drives as a Hot Fix drive. Thus, several Array Drives can share one Hot Fix drive. Of course, once this drive has been used by one of the Array Drives, it is no longer available for the others.


GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
(C) Copyright 1994-1997 ICP vortex Computersysteme GmbH
Array Drives
Array Drive 0: RAID-5: ready Size[MB]: 400
View/Chg.
Controller
Disk Drive Positions
No. Position Chn. ID Status Vendor Type Attr. Size[MB] Drive
0 PCI 0/9 A 0 i SEAGATE ST52160N RW 2068
1 PCI 0/9 B 0 i QUANTUM P105S 910-10-94x RW 99
2 PCI 0/9 C 4 i SEAGATE ST52160N RW 2068 Fragment
3 PCI 0/9 A 1
4 PCI 0/9 A 2
5 PCI 0/9 A 3
6 PCI 0/9 A 4
7 PCI 0/9 A 5
8 PCI 0/9 B 1
Select the position of the new disk drive
GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

We select SCSI Channel C and ID4 for the new Pool Hot Fix Drive.


GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
(C) Copyright 1994-1997 ICP vortex Computersysteme GmbH
Array Drives
Array Drive 0: RAID-5: ready Size[MB]: 400
View/Chg.
Controller
Cache Sett
Physical D
Logical Dr
F2: Drive Information
Array Drive
Array Drive Components
Log. Drive 0: Disk: ok Size[MB]: 200 Master
Log. Drive 4: Disk: ok Size[MB]: 200
Log. Drive 2: Disk: ok Size[MB]: 200
Log. Drive 1: Disk: ok Size[MB]: 2068 Hot Fix (Pool)
F2: Drive Information
GDT

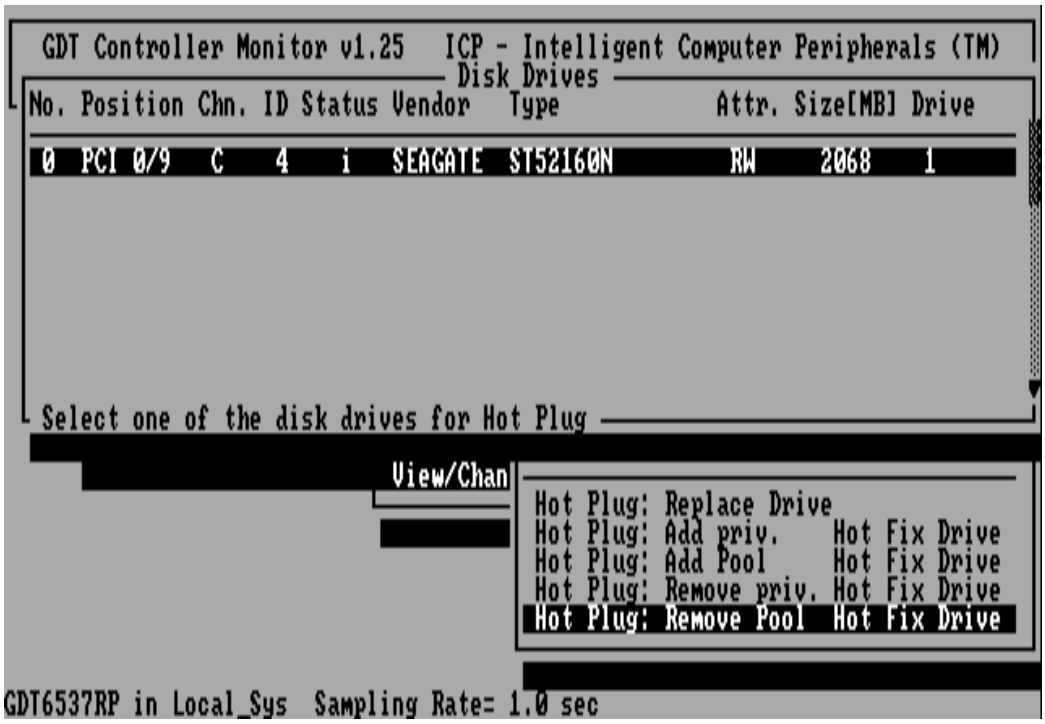
You may disable or enable the access of a certain RAID 4/5 Array Drive to the pool of Hot Fix Drives with the option "Pool Hot Fix Access" (see G.3.6.4).

G.3.6.8 Hot Plug: Remove Private Hot Fix Drive

This function is used, if you want to remove a private Hot Fix Drive from an Array Drive.

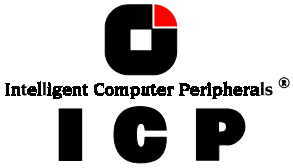
G.3.6.9 Hot Plug: Remove Pool Hot Fix Drive

In a similar way as with the "Remove private Hot Fix Drive" function, here you can remove a Hot Fix Drive from the Hot Fix Pool. A possible reason for this could be that you want to add it as a private Hot Fix Drive to an Array Drive.


GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
Disk Drives
No. Position Chn. ID Status Vendor Type Attr. Size[MB] Drive
0 PCI 0/9 C 4 i SEAGATE ST52160N RW 2068 1
Select one of the disk drives for Hot Plug
View/Chan
Hot Plug: Replace Drive
Hot Plug: Add priv. Hot Fix Drive
Hot Plug: Add Pool Hot Fix Drive
Hot Plug: Remove priv. Hot Fix Drive
Hot Plug: Remove Pool Hot Fix Drive
GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

G.3.7 Save Information

The *Save Information* option gives you the possibility to save the configuration information regarding the selected ICP Controller and its devices in an ASCII-file. This may help if you require support and is also good for your system documentation.


Intelligent Computer Peripherals ®
ICP

Chapter H

Appendix

Intelligent Computer Peripherals ®

ICP

H. Appendix

H.1 Technical Data of the ICP Controller

Board Sizes	Standard PCI long card format or 2/3 of it
Weight	0,35 kg
Temperature Range in Operation (measured in the enclosure)	10° to 35° C or 50° to 95° F
Temperature Range not in Operation	-10° to 60° C or 14° to 140° F
Humidity in Operation	20% to 75% not condensing
Maximum Altitude in Operation	3000 meter or approximately 10.000 feet
Power Consumption (5V, 12V)	approximately 10 Watt

H.2 Power-On Error Messages Issued by the ICP Controller

The following error messages are displayed only after a cold boot of the system.

Error Message	**possible cause, remarks**
"Error detected on SIOP 1"	SCSI cable defective hard disk connected defective SIOP x defective
"Memory error detected“:	SIMM Module defective

Memory errors of the ICP Controller are also indicated acoustically with the audio alarm of the ICP Controller (3 beeps repeated every 10 seconds).

The following audio alarm sequence indicates that the ICP Controller is being operated without a SIMM: "beep-beep-short_pause-beep-beep-long_pause-beep-beep-short_pause-etc.".

H.3 Index

Acoustical Alarm 90
Acoustical Alarm, RAM failure 216
Activate the primary DOS partition 128
Architecture, 32-bit 19
ARCserve, Backup Software 147
ASPI 20, 71, 134
ASPI Interface 134
ASPI Manager 134, 137
ASPI module 134
ASPIDISK.SYS 137
ASPISCAN.EXE 137
ASPITRAN.DSK, ASPI Layer 144
ASW ASPI module 137
Backup 6
BBS - Mailbox 16, 58
BIOS of GDT Controller, shadowing 55
BIOS Version, updating the ICP controller 58
BIOS, DPMEM, mapping 54
Cable Length – 12 meters 15
Cache algorithm 19
Cache RAM 15, 19, 30
Cache RAM detection, automatic 15
CD-ROM Drive 134
CMOS components 18, 30
Configuration Data of the Disk Array 170
corelSCSI 70, 134, 135, 136
CPU cooler 60
CTPCI, c't magazine PCI tool 133
CTRLSRV.CFG 160
CTRLSRV.NLM 160
CTRLTRAN.DSK 144
Delayed Write, option 58
Differential SCSI 32
Disconnect 75, 94, 158
Disk Array, Maximum Number of Drives 122
Disk Arrays, Build State 124
Disk Arrays, Error Status 125
Disk Arrays, Expand State 125
Disk Arrays, Fail State 124
Disk Arrays, Hot Fix drive 112
Disk Arrays, Hot Fix Drive 112
Disk Arrays, Hot Fix Mechanism 123
Disk Arrays, Hot-Plug RAID 4/5 158
Disk Arrays, Idle State 124
Disk Arrays, Level of Redundancy 123
Disk Arrays, Minimum Number of Drives 122
Disk Arrays, Online Capacity Expansion 158
Disk Arrays, Online RAID level migration 158
Disk Arrays, Phase Diagram 124
Disk Arrays, RAID 0 102, 113
Disk Arrays, RAID 1 15, 62, 63, 123
Disk Arrays, RAID 10 15, 102, 113
Disk Arrays, RAID 4 15, 63, 102, 113, 123, 158, 164
Disk Arrays, RAID 5 62, 102, 113, 123, 158
Disk Arrays, Ready State 124
Disk Arrays, Rebuild State 124
Disk Arrays, Stripe Size 103, 114
Disk Duplexing 90
Disks, Initialization 71, 73, 92
DPMEM - Dual Ported Memory 53
DPMEM - System BIOS problems 54
EDO SIMM 15, 19
EDO-SIMM 31
error messages 216
Examples for SCSI cablings 44
Expanded Memory Manager 133
Express Setup 67
External SCSI Terminators 91
Factory setting of jumpers 21
Fast Page Mode SIMM 15, 19, 30
Fast SCSI 32
FAST-20 32
FAST-40 32
Fast-SCSI Bracket 41
FCC Compliance 7
Firmware, updating the ICP controller 58
First Initialization of a SCSI-device 75, 95
Flash-RAM 15, 17, 20, 58
Flushing the Controller Cache 60
GDT ASPI Manager, GDTASPI.EXE 137
GDT boot message 53
GDT_RPFW, file 58
GDT6118RD, LEDs and Connectors 22
GDT6128RD, LEDs and Connectors 24
GDT6518RD, LEDs and Connectors 23
GDT6528RD, LEDs and Connectors 25
GDT6538RD, LEDs and Connectors 26
GDT6558RD, LEDs and Connectors 27
GDTASPI.EXE, Parameters 137
GDTMON, Disable Audible Alarm 183
GDTMON, Expand Array Drive 194
GDTMON, Grown Defects 173
GDTMON, Hot Plug function 170
GDTMON, Hot Plug mechanism 171
GDTMON, Hot Plug RAID1/10 177
GDTMON, Hot Plug RAID4/5 199
GDTMON, Intelligent Fault Bus 171
GDTMON, Last Status information 173
GDTMON, Parity Recalculate 193
GDTMON, SAF-TE 174
GDTMON, Save Information 213
GDTMON, The Diagnosis Program 158
GDTRP310.DSK, Driver vor NetWare 3.10 144
GDTRP311.DSK, Driver for NetWare 3.11 144
GDTRP312.DSK, Driver for NetWare 3.12 144
GDTRP400.DSK, Driver for NetWare 4.x 145
GDTX.SYS, Driver for Windows NT 150
GDTX000.EXE, Driver for MS-DOS 132
Hardware Installation of the ICP Controller 30

Hierarchy, Level 1, Physical Devices 70
Hierarchy, Level 2, Logical Drives 70
Hierarchy, Level 3, Array Drives 70
Hierarchy, Level 4, Host Drives 70
Host Drives 70
Hot Fix Drive, Creation 115
Hot Fix Drive. Mechanism 118
I_20 ready 15
I_2O Special Interest Group 16
i960RD 15, 19
ICP controller Configuration 55
ICP SCSI Accessories 41
ICP vortex Computersysteme GmbH 16
ICP vortex Corporation 16
Installing the GDT controller 50
Installing the GDT Controller, Trouble Shooting 54
INT A - IRQ assignment 52
Internet - E-Mail 16
Jumpers and LED connector 21
LEDs of the GDT controller 52
LVDS/SE Terminator 41
LVDS/SE Terminator for SE/LVDS Hard Disks with SCA Connector 41
Mirroring-Array 83, 89
MSCDEX, CD-ROM extension 135
Multiprocessor RISC Technology 15
Narrow-Wide-SCSI Bracket 41
NCPE Protocol 158
NETBIOS Protocol 158
NetWare, Cache Memory Allocator 146
NetWare, Optimize Throughput 145
NetWare, Tips & Tricks 145
Not Direct Access Devices 71, 137
NT Advanced Server Variant 150
NT Workstation Variant 150
Online Capacity Expansion 15
Operating System Drivers 21
Parity Verify 108
Partitioning a Host-Drive 128
PCI 2.1 compliant 19
PCI bus-master slot 50
PCI compatibility 15
PCI compatibility, Plug & Play 51
PCI INT A 53
PCI interrupt, assignment to IRQ 52
RAB, RAID Advisory Board 16
RAID 0 - Definition 64
RAID 1 - Definition 64
RAID 10 - Definition 66
RAID 4 - Definition 65
RAID 5 - Definition 65
RAID functions 20
RAIDYNE Upgrade 62
RAIDYNE-Firmware 20, 63
README.ENG File 18
Read-Write-Status 73, 93
Reassign, GDTMON 167
Replacement of a defective drive 112
Retries, GDTMON 167
SCA Connector 43
SCSI Basics 32
SCSI Bus Termination 38
SCSI bus termination, active 19
SCSI bus, synchronous transfer 75, 94
SCSI bus, terminator power 50
SCSI cable length 50
SCSI Cables 33
SCSI ID 40
SCSI RISC processor 15
SCSI terminators 50
SCSI-ID 50
SCSI-II/III Options 75, 95
SIMMs, Recommended 31
Simulating a Drive Failure 109
Single Ended SCSI 32
Software License Agreement 17
Standard firmware 20
Synchronization, Mirroring update 185
Tagged Queues 158, 164
Ultra SCSI 32
Ultra2 SCSI 32
Updating the ICP Controller with new Firmware 58
Using Microsoft MS-DOS 128
Using Microsoft Windows NT 150
Using Novell NetWare 144
Using Windows 95 139
Virtual DMA Services 132
Warranty 4
Website 16
Wide & Ultra SCSI 15
Wide/Ultra SCSI Flat Ribbon Cable 41
Wide/Ultra2 14, 32
Wide/Ultra2 - LVDS 33
Wide/Ultra2 SCSI - SE/LVDS Termination 19
Wide/Ultra2 SCSI - Up to 5 Channels 19
Wide/Ultra2 SCSI RAID Controllers 14
Wide/Ultra2 SCSI RISC processors 15
Wide-SCSI Adapter 41
Wide-SCSI Bracket 41
Windows NT, GDTSETUP 21
Windows NT, Master Boot Record 151
Windows NT, NTPREP 151
Windows NT, Raw Devices 154
Windows NT, Size of the boot partition 151
Windows NT, Updating 3.51 to 4 155
Windows NT, Updating the GDTX.SYS driver 153